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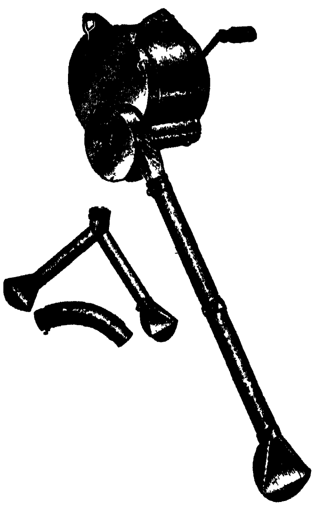
TO OUR CONTRIBUTORS.

Paper is still in short supply. The cost of printing is high — and the Editorial Board will feel obliged if your articles are brief.

"ROOT"

ROTARY HAND DUSTER



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The Madras Agricultural Journal

(ORGAN OF THE M. A. S. UNION)

Vol. XXXVI October 1949 No. 10

Editorial

Training the Research Worker: The reorganisation of scientific research and university education in Independent India, on lines, which would enable her to keep pace with the rest of advanced countries in the world, in the matter of industrial and academic progress, is now engaging the attention of our statesmen and leading scientists. In the editorial columns of a recent issue of 'Nature' are discussed certain aspects relating to modern trends in organisation for scientific research, which are well worth a close study. "The division of the world into two sharply contrasted groups has repercussions in the field of science and of scientific research if no more than as affecting the ideas which men hold about the freedom of science". The progress in pursuit of knowledge is made rapidly and securely only when individuals are free to entertain any hypothesis, and when the survival of the hypothesis is determined soley by the rigour of test against cold facts, and not by any arbitrary ruling: and political dogma should never be allowed to dictate the teaching and practice of science". In selecting personnel for scientific research it is of utmost importance that the individuals chosen should have besides outstanding intellectual urge, of a personal nature, the ability to co-operate with collegues of equal attainments and ambitions. As much of modern advanced research is team work carried out on a planned basis, the possibility should be avoided of an obdurate lone worker impeding the evolution of joint integrated programme of research by a group of men. The most important single attribute of a scientific staff should be the ability to perform as a group the function estimating and balancing integrating and interrelating. The importance of universities maintaining their independence is emphasised for the main source from which to draw the research workers for scientific development will be the universities. The academic values of passion for truth, thoroughness in pursuing it to its end, a delicate precision in analysis a judical temper a willingness to learn from all quarters

and an uncompromising insistance on freedom of utterance, should be upheld as basic values in any university worth its name. Any teacher who tolerates intellectual dishonesty is out of place in an university. Over adulation of post graduate research results in the fresh student not educating himself. "A university needs to encourage and honour not only discoverers of facts but also explorers of ideas and appraisers of values. If it does this and can at the same time mark out those relatively few whose talents appear to fit them preeminently for a course of research it will have done more to meet the needs of Academic research, the Research Institutions and Industrial Departments than by fostering large, schools of directed research. The post graduate side of a university should never degnerate into a research factory. The Universities should bear in mind that they have to justify the public expenditure on them by returning to the nation men and women of trained first class minds capable of filling responsibilities of leadership, of character, ability and high standards of technical skill.

Agricultural Research and Propaganda: Our readers have been presented with several views on this problem, dealing in detail on aspects of acquainting the cultivators with the progress in research. Almost all of them have struck the same path, and stress the use of films, radios, talks, lectures, songs, leaflets etc., while some of them have doubted the efficacy of district farms in this aspect. Mr. Naik, however strikes a different path. He argues that such methods of propaganda copied from other countries and transplanted into an Indian village at the present state of development does not bear fruit. He stresses that for the majority of the cultivators actual demonstration on the spot living the cultivators own life but at the same time demonstrating what could be done leaves a deeper impression. The Model state Farms as he calls them should be distributed through the entire province. In short the main theme of his argument is that example is better than precept.

Our Prime Minister: The Prime Minister of India has been sojourning in America and we learn with pride that he has been given a rousing reception. We earnestly hope and pray that the visit of the Prime Minister will mark a beginning of active co-operation of the eastern and western himspheres, for the welfare of the people of the world and ensuring its peace.

Research and propaganda, a plea for re-orientation*

By
K. C. NAIK
(Fruit Specialist, Madras)

In our drive towards self-sufficiency in food production, the paramount need to pass on the results of research to the ryot with effect, economy and expeditiousness has been stressed from all quarters. It will be generally conceded that our propaganda organisation in all parts of the country has been modelled more or less on a uniform pattern with taluk or district demonstrators forming the main core of the organization and with seed, manure and implement distribution as their chief functions. Intended primarily to be the mentor and guide to the ryot and overwhelmed by a lot of routine and more recently by the trading scheme duties, the advisory activities of the demonstrator have receded to an extent to the background. Even under normal times, it is doubtful if the rigid compartmentalisation of extension service and research wing is conducive for efficiency. With no direct contact with any field of research and with little or no scope to keep himself abreast with the day-to-day advance in progress of agricultural science in its varied forms, the demonstrators' advisory function cannot but reduce itself by force of circumstances to a few set maxims, which may be monotonous to the well-informed ryot and rusty or even obsolete from the modern scientific standards. This eventuality may be an extreme conception, but the very possibility of it should make us think of a plan that would perpetually maintain the keen edge of propaganda in such a manner as to influence the agricultural practice to the maximum and widest extent possible.

If we accept, as we must, that extension service should be constantly fed by the results of research, it follows that there should also be a vehicle through which this free flow of knowledge between the two lines of departmental activity is possible. It has, however, to be remembered that research is proverbially slow and uncertain of results. Our popular crop strains and most of our improved agricultural tools and practices have been evolved or chosen for advocating to the ryots after years of toil in laboratories and fields and after laborious tests. This is why most of the items of our propaganda of to-day are not far removed from those a decade or two ago. Our annual reports of agricultural stations can never claim to make substantial additions to alter the course or shape of extension service every time they are issued. They only register the milestones in our progress in research activities and do not delimit the destination point. It would be as ridiculous to expect our research stations to produce an efficient crop strain every year, as it would be to expect an improved agricultural practice to be recommended with every change of demonstrator in

* Paper presented at the 32nd College Day and Conference.

any centre. The research reports produced annually are essentially comprised of hypotheses, which are the pre-requisites of inferences. While these reports are important to scientific workers in affording the only reliable means of judging the appropriateness of approach to the problems and of the extent of advance made towards the solution of a problem during the period, they cannot be of much help to alter the lines of propaganda or enhance the benefits therefrom. It will be risky, if not positively dangerous, to model our extension work on hypotheses and surmises.

The only rational view under the circumstances is that, while the extension worker has to be always alert to imbibe the periodic progress made in the field of research, his *modus operandi* may not lend itself for frequent changes, owing to the fact that the stimulus for such changes is unpredictable in origin. This cannot be an argument for divorcing extension work from research, but for vigilance combined with inter-dependance.

From the point of view of the practical agriculturist, the departmental propaganda is of two distinct categories, one that will cater to the vast majority of what may be called as the conservative or relatively backward section of ryots, and the other that will meet the needs of the more progressive but smaller section. The value and extended use of green manures, of soil production and conservation, of compost making and exploitation of farm waste materials, roguing out in nurseries and fields, of maintaining purity of seed material, of growing only strains of proven merit, of the timely and adequate control of pests and diseases, and of a proper crop rotation—these are types of propaganda that are applicable in most years and seasons and in wide stretches of the province more or less on a standard regional basis. Every ryot needs to be impressed on the value of each of these measures; some repeatedly and some occasionally. There are no two opinions on the value of these items of propaganda and there is no special type of mental equipment or skill needed for carrying out the extension work in respect of such items. It may be unnecessary, if not useless, to employ scientifically trained agricultural graduates for this type of extension work, which has varied little with the passage of time.

It seems that these items of propaganda can be entrusted with economy and advantage from the view-point of effectiveness to picked but practical ryots, who by virtue of their status and character, enjoy the confidence of a bulk of ryots in a village or firka. Our agricultural propaganda in the past half a century or more can be expected to have permeated sufficiently wide as to make it easy to pick out a number of ryots in each firka, who adopt some, if not all, of the departmental recommendations. The selected propagandists may hold office for a period of two or three years, during which it should be possible to expect of them to model their own farming practices strictly to conform to all what we advocate. Who can fill the role of propaganda better than the owners of

such model farms? A short course of training may perhaps be necessary before these men are drafted for their part-time duties, but this can be done by the trained agricultural demonstrators. The remuneration of these village propagandists may be sufficiently attractive as to provide the incentive to continue the performance of the duties with devotion and enthusiasm. This type of practical part-time and paid agricultural propagandists is by no means a novel scheme. The village officers as the Karnam and Village Munsiff are also part-time Government servants. If our whole land revenue system is worked by such a medium, there is no reason why the agricultural system cannot be made to develop and improve on a similar pattern. The agricultural improvements can be expected to be more speedy and tangible when it is vested in the hands of persons who live amidst the ryots, move daily with them, speak their language, share their thoughts, participate in their joys and sorrows and possess a tie of kinship in innumerable ways. The highly trained and sophisticated propagandist from a taluk or district headquarters has often been dubbed a misfit in our village atmosphere and can hardly inspire confidence among the villagers. The taluk demonstrators may continue to exist in order to train, guide and supervise the work of these village or firka agricultural propagandists and to enforce the conditions that every propagandist should himself set the example by practising all the precepts that he preaches. This is an acid test for the success of the scheme. To enhance the utility of the scheme, it will be desirable to select these ryot propagandists annually or every two or three years. The selection may be on a competitive basis as judged on the nature and quality of work done and on the excellence of agricultural practices achieved, and also on the propaganda ability possessed by the candidates. The system is designed to promote and foster a healthy spirit of competition among the ryots, which by itself will be a fillip for agricultural improvements.

In effect this system will lead to the establishment of model farms in every village or firka without any Government funds being directly expended on them. An outcome of the implementation of the above proposal will be that, while it will cater to the vast bulk of ryots who are amenable to this type of propaganda by persons living and mixing with them always, the progressive, educated and scientifically alert group of farmers have to be provided differently and at a higher level. This group of persons, though numerically small, is generally more well-to-do and is, therefore, readily responsive to well-informed propaganda. They are practical, intelligent and do not need the type of extension service dealing merely with elementary items of which they are already aware. They are not of a type to take any new improvement without question but no new improvements can be popularised except after convincing this group and then arranging to disseminate to the more conservative section of the ryots citing the examples from richer educated sections. Particularly in

the field of horticulture, the demand for advice is from an intelligent class of ryots who may themselves be fairly advanced in their art. This class of people can be tackled only by well-trained persons actually in contact with farming practices and research and specially trained for their duties. A district officer solely engaged in routine work and with no opportunities to take active interest in research may be adequate for guiding the propaganda intended to popularise well-known practices and strains of proven value. Subjects that require specialised knowledge, skill and careful planning, born of conviction and awareness of the value of scientific farming, can only be dealt with by a different type of propaganda personnel for which a separate organisation seems necessary.

Clubbing these two lines of propaganda under one wing has been in a large measure responsible for the ineffectiveness of our extension work in the past. It is as useless to enunciate the finer scientific principles to an uneducated and unintelligent ryot, as it would be to din the commonplace to the progressive farmer. Above all, the prevalent and erstwhile system may often serve only to lower the efficiency and standard of propaganda workers, who are not provided with any incentive to keep themselves abreast with scientific advances.

Summing up the present position, it would appear that a re-orientation of our extension service is urgently called for. In this the balancing of research and propaganda activities must occupy the premier place. The free flow of information for efficiency in propaganda must be ensured by firstly, extending and intensifying research and secondly, by providing for a more intimate link between research and extension work. The compartmentalisation of research and propaganda only serves to antagonise these two wings of the department to the detriment of both, and more important still to prejudice the farmers. To cut across the existing anomaly, it may involve a thorough overhaul of the departmental organisation. In considering this subject one of the most common errors which, we are apt to fall into, is to stress the so-called analogy from other lands chiefly from Europe and America. The efficiency of any publicity or propaganda campaign must depend to a very great extent on the mental calibre of the persons for whom such a campaign is meant and to even greater extent on their psychology, their training, language, environment, economic condition, character, national, regional or communal habits and social set-up. Those who suggest a specific type of propaganda for a province or a country on the analogy of American or European model are only over-simplifying the problem, which is not the same thing as solving it.

Organisational efficiency combined with a high educational standard and high standard of life may all demand a type of publicity or propaganda campaign quite different from that to benefit an economically backward country like India. The Californian Orange Growers Exchange

is reported to have spent over £ 1,25,000 in Great Britain alone in a period of four years for advertising the value of grapefruits as a breakfast food, and with such effect that to-day the grapefruit has become an almost universally favourite food to start the day with, in innumerable British homes. We can well imagine the tremendous loss to the Exchange if such a publicity campaign had been conducted in India. Our food habits and tastes as well as the educational backwardness and low economic conditions of our masses will all have provided an arid barren ground on which all the advertisement talent and money would have been wasted.

If our existing propaganda is a misfiit, or not sufficiently effective, and foreign methods cannot be easily adopted in our country, what is it that we can suggest as a solution? An answer to this should have to take note of all the peculiarities of our Indian ways of life, and of our mental make-up. One of the foremost points that merits attention in any discussion on the suitable type of propaganda for agricultural improvement is the fact that unlike in most countries, our agricultural farming is composed of two main classes of persons, one, consisting of a majority of tenant farms and the second of a minority of rich landlords. The former are generally impervious to our propaganda, steeped as they are in poverty and with no educational or cultural attainments that can enable them to appreciate closely reasoned advice, in whichever manner it reaches them. In a land of peasant proprietors, owning the land they till, and where the benefits of every improvement adopted is to be reaped by the owner of the land himself, the urge to search for every means of improving the agricultural practice is perpetual. The higher standard of life and the markedly higher economic condition of the agriculturists are other favourable conditions for the successful working of the propaganda machine. On the other hand, in this country it often happens that the richer class consists of either absentee landlords or those having only a casual interest in certain types of agricultural improvements, such as that of improvement of irrigation facilities due to which the results are speedy and ocular and the returns appreciable to the landlord. Against this background of India's agricultural set-up, it is idle to expect that the provision of a propaganda officer such as an Agricultural Demonstrator at the rate of one per taluk solely for propaganda and without any other ramifications of direct extension service, can result in any appreciable improvement in our agricultural prosperity, especially as such officers have no means to effect any change in the numerous handicaps that the common ryot is suffering from.

Regarding the methods of propaganda also, it is common to hear among the suggestions for improvement some quite attractive and apparently efficacious ones, but which are totally divorced from the realities of the situation. If films have shaped the habits, dress and culture of people in foreign countries and even in some of our urban areas,

we should not expect equally tangible or spectacular results through this medium for agricultural improvement. It is doubtful if even a small section of actual agriculturists attend the cinema; and among these that do so occasionally, whether even a fraction of the people are convinced of the utility of a recommendation. For many years to come, films will remain a pastime; and their educational or cultural value is yet to be proved on a mass or country-wide scale as in India. At best the film may just ruffle the still pools of thought and afford a comparative idea for discussion. But the age-long agricultural practices of our forefathers are not likely to get a material shake-up by a few film shows. Man's mind is not pliable, nor our country so small, nor our agricultural practices so few and so standardised, nor our film publicity for agricultural propaganda so perfect, as to work a miracle in our agricultural farming.

Lectures and radio talks as well as the exhibitions on shandy days or along with reputed local events and celebrations, cut no more ice than film propaganda. Here the means of propaganda is primarily personal in nature and its merits or demerits are liable to be altered, depending on the lecturer or showman and his capacity for the task. Who does not know the wearisome boredom that most in a rural audience experience after hearing some long speeches of extension staff? To believe solely on this type of propaganda to do the trick, is to continue the game of self-delusion. Almost on the same part are the departmental publications. Most of these are beyond the reach of the average ryot; the few who read them take only a casual interest in such media of propaganda, and only a small section of the ryots are actually benefited by it appreciably.

This leaves out one type of propaganda which, in my opinion, has not had a real trial so far in India. I refer to the establishment of a network of Model State Farms at the rate of one per taluk. All these state farms should be laid out and run in an up-to-date scientific manner, where only the best strains of crops are grown under ideal conditions and where bumper crops are gathered, and where precise cost of production and of revenue are worked out for any who care to study them. Each of these farms should be in the charge of men, who have had not less than 5 years of farming experience and preferably 10 years. With a minimum staff responsible to the Chief Farm Manager, and for assisting him, this farm should demonstrate what is possible through scientific agriculture. The staff should all have good and decent quarters and all possible amenities, so that the form should be the ideal in every way to the ryot, showing him what comforts and conveniences one can enjoy and yet secure higher margins or profit from agriculture than by the present methods. The farm may meet the demand for pure seeds, for tools, manures and insecticides and fungicides and other agricultural requirements, for all of which there may be an assistant under the supervision of

the chief Farm Manager or the District Agricultural Officer, whose headquarters may also be at the same place; and both to be under the control of the Regional Deputy Director.

In conclusion, it is well to bear in mind that propaganda when not well fed by results of research can be just a flop, if not a tragedy. Even so, the methods of extension work can cut no ice if they are not shaped to suit the calibre, prejudices and socio-economic habits of our people. For securing utmost efficiency with economy, the extension work shall have to be integrated with research, and it is suggested that Model State Farms in each district and taluk with propaganda personnel drawn from every village or groups of villages from amidst practical agriculturists and who should themselves be maintaining model forms, offers the only feasible plan of action. The demonstrator of to-day and the common ryot are two apparently incompatible entities, and so are the former and the scientifically progressive specialised producer of crops like fruits, vegetables, spices, plantation crops, etc. It is time we evolve a plan in which the results of research are transplanted to different classes of ryots by persons of different calibre and training. State Model Taluk Farms dealing with all crops of importance to the taluk will provide just that reliable ocular demonstration which all can accept without question. Such farms with their skilled and practically experienced staff can find just that meeting ground with the progressive section of our ryots, which is sorely lacking to-day. To the rest of the ryots, the unofficial model farm maintained by the part-time village propagandist who are themselves practical farmers, will afford a perpetual object lesson, providing at the same time a most economic and efficient medium for the spread of all scientific agricultural improvements.

Crop planning for the Thungabhadra Project ayacut*

By

Dr. S. KASINATHAN, B. A., PH. D.

(Deputy Director of Agriculture, Thungabhadra Project, Bellary)

The Thungabhadra Project, as now finally proposed, is intended for the benefit of the stretch of country along the course of the river of the same name and lying in a 10 or 20 mile depth southwards in the districts of Bellary and Kurnool. Started at first almost wholly as a protective scheme for the famine stricken areas of the two districts, it is now being planned as a developmental programme aiming at increasing the general standards of living of the people of the area through improved agriculture and industrial ventures of assured profits.

*Paper presented at the 32nd College Day and Conference.

The parts of the province actually coming under the project, have in fact several of the requisites for operating successfully programmes of development. They are,

(i) the area will soon come to possess facilities for power and water for irrigation. There will be great scope for varied types of economic development with intensive and choice agriculture as the background.

(ii) It has, like other tracts where developmental programmes were worked with success, a geographical unity over a wide enough landscape and enjoys a considerable measure of unified and administrative control and has a homogenous population.

(iii) the tract is characterised by only two types of soils mainly the red and the black almost wholly uninterrupted by intrazonal spreads, which makes for easy and efficient planning of cultivation systems.

(iv) being subject for ages to an arid but not desert type of climate and derived mainly from lime-rich parent materials, there is, over its greater part, considerable depth of fertile soil material of high productive capacity. Adequately manured, it is possible to obtain ordinarily a five to six fold increase of cereal yields and three to four fold increase of economic crops like cotton and groundnut. It is further possible to raise a variety of crops of industrial and agricultural value. There is thus great scope for planning for profits, but the one main factor that stood, for long, in the way of development, was its uncertain and precarious rainfall; the advent of the project opens up the prospect of launching, with surity of success, developmental schemes to all of which the agriculture of the tract is basic. However, certain peculiar features, of the tract as a whole demand primary consideration and efficient and ordered handling; planned production and perhaps, production of even specified kinds, appears needed if the success envisaged should be realised.

Lack of adequate capital: Irrigation agriculture offers certain difficulties in its immediate practice on the undulating terrain of the area and the lands require a minimum of improvement in the shape of levelling and terracing before water can be used on them; and this has been estimated as likely to cost considerable sums. The average ryot may find it either too high for his means or may lack the strength of sufficient faith in the need for the improvement. Even more important than the above is the consideration of "men and means". The tract has an average population density of only 200 per million and a cattle wealth which admits of only one pair for every 30 acres of cultivable land. It has thus too few men and fewer cattle for the high level of cultivation required under irrigation agriculture. With the natural tendency of the ordinary ryots to grab at more land than he can effectively handle or

manage, unprofitable systems of development may come to be practiced, for long enough period leading to deterioration of the land and decreasing levels of crop production. Crop planning and if necessary even its enforcement may therefore have to be given high priority in the scheme of things that will make for the assured development of the area.

Results of the Agricultural Research Station: Work has been going on under government auspices for over a decade and has now reached a stage when there are available a large number and variety of crops that can be raised at remunerative levels. We have in addition sufficient knowledge of the water and manure requirements and optimum periods of growth for fitting the crops on to the soils and seasons in any desired or planned manner. With the crops commonly cultivated in the tract, it may be computed that a net increased return ranging from Rs. 33 to 83 per acre can be expected under irrigation and ordered planning to fix these crops into suitable cropping schemes and to regulate their relative extents should prove of great value.

Information on such plans is, however scanty and the few lines that have been worked so far are of the nature of a simple introduction of the existing crops and schemes of cropping into the newer conditions. In the dry cultivated tracts of the area, crop planning is based on the same crops as above; jonna and groundnut being raised on red and shallow black soils, in the Mungari season; cotton being raised in the heavy black soils, in the Hingari season. Experience on the farm has led however to the conclusion that while adequate profits can be realised by irrigating these crops, the detailed plans of cropping the lands in Mungari and Hingari seasons require considerable modification before the water of the project can be made use of for irrigation. The conclusions arrived at were, (i) the adaptation of the existing dry land scheme to irrigated areas requires the segregation of the lands into Mungari and Hingari blocks and this would greatly disturb the agricultural economy of the ryot giving more food to the mungari ryot and more money to the Hingari ryot and (ii) the alternative plan of rotating the lands between the two schemes of Mungari and Hingari cultivation presents difficult problems of cultivation.

Indications of work during these earlier years on the farm work, on allied aspects of crops and seasons and cultivation open up the possibility of circumventing the above difficulties and of devising of different plan of cropping with the same background of finding for each ryot, some food to eat, sufficient fodder to feed his cattle on and as much money in addition as he can get for purchasing his other requirements. Under irrigation it has been found possible, in fact desirable, to grow the Hingari crops early in or even before the Hingari season, thus obliterating to a large extent the differential effects of the two seasons. This

enables a uniform cropping plan for both the seasons with all the advantages of irrigation agriculture. As instances of cropping plans of such general applicability may be cited the following which are now under study at the agricultural research station,

	Sown in	Harvested in	
Groundnut and Red gram	June — July	Sept. — Oct.	1st year.
Jonna	June	Sept. — Oct.	2nd year.
Green manure followed by wheat	June - Oct. — Nov.	August — February	3rd year.
Cotton	August	March	4th year.

Whatever may be the final outcome of these trials, the two schemes have much in common in both their immediate aims and methods used. Their aim has an essentially rural background more food, surer food and as much extra money as can be had. This is much unlike devolopmental schemes of compact areas in other parts of the world and if maximum benefit is to be derived from the use of the facilities of power and water, the aim of our planning may well be "adequate food if possible but at any rate adequate means to secure same".

It is worth while examining the formulating of the conditions that planned production should aim at satisfying. The objective of all schemes of agricultural development should either be a state of self-sufficiency in respect of food requirements which may be considered full in itself; or one of specialised development with an industrial outlook. The former is beyond doubt of paramount importance in the development of an administrative unit as a whole such as that of a province or a country but in trying as in the present case of developing a compact region of a major province, considerations of over all gain to the tract in question may take precedence over mere insistence on a self-sufficiency plan in respect of food. The objective set by the author of the special investigations of the condition of the project, Sri T. N. S. Raghavan, and on whose findings the work of the project is being defined and ordered, is rightly the latter one of an integrated development of the tract as a whole.

Against the above background, I have examined below the implication of a self-sufficiency programme to the future prosperity of the tract. It is well to emphasise even at the outset that, so long as the cropping plan for the tract aims at increased production of the same crops as the dry tract, programmes of self-sufficiency should be formulated for the entire area of which the developmental region forms a part. This is particularly the case in the present instance as most of the organised markets lie outside of the project area.

An analysis (vide appendix) of possible production of the cereals and the requirements of the population for self-sufficiency given below making use of the method adopted by Sri S. Y. Krishnaswami Iyer* in his monograph on rural problems. On the basis of this analysis, self-sufficiency cannot be attained as a result of the available irrigation facilities and it is worth while examining if and to what extent emphasis can be shifted to industrial crops. We have at present insufficient data to decide these issues; but the possibility of planning the agricultural economy of the tract on the model of other food deficient areas, (like Malabar or Travancore in the Province or Malaya, Ceylon, Java etc., outside India) may prove of more lasting benefit.

APPENDIX

Population of the districts of Bellary and Kurnool.	22 Lakhs.
Increase of labour population that is needed for practicing irrigation (66% of the population of the ayacut).	1·8 lakhs.
Total population of the two districts.	23·8 lakhs.
Total population in terms of equivalent adults.	23·8 x 0·75 or 17·85 lakhs.
Food requirements in tons of husked millets required to feed the above population at 28 oz. per adult per day.	4·46 lakhs of tons.
Available food (including the average increased production under irrigation agriculture of the proposed area):	
Production in tons of dehusked millets	Bellary : 167,000. Kurnool : 172,000
Anticipated increase in tons of dehusked millets estimated to result for the use of irrigation of tract:	45,000
Production of paddy in terms of tons of rice for the 36,000 acres of the ayacut at 2,000 lbs. of paddy per acre:	20,000
Total production available:	4·04 lakhs.
Deficits:	0·46 lakhs of tons of dehusked millets.
Area required:	69,000 acres.

*Krishnaswami S. Y., 1947 Rural Problems in Madras Presidency—a Monograph—Superintendent Govt. Press, Madras.

A study of the composition of well waters in and around Bapatla

By

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PART I.

With the starting at Bapatla, in July 1945, of the second Agricultural College, one of the prime considerations was to ensure a continuous uninterrupted supply of water for the College laboratories and for the residential hostels. At Bapatla the soil is sandy, and the water table is very high, being almost within 2 feet from the surface during the rainy months and about 8 to 10 feet in the summer. A common feature of the tract is the presence of a number of '*doruvus*' scattered within a few yards' distance of each other. A *doruvu* is a shallow excavated depression about 8 ft. deep, the cost of getting one ready being within Rs. 10 to 15. These are the sources of irrigation, which is done by splashing, for crops, like paddy and tobacco nurseries, ragi, brinjals, chillies and other vegetables raised round about Bapatla.

At the time the building and site were acquired for the college, there were a few *doruvus* of this type within the premises, with built-up parapet walls. One of these, near the hostel was decided upon to supply water to the new college. A pump was installed in this well and water pumped to overhead tanks of the college building to meet the needs of the college laboratories and the hostel. It was soon found that the well was not able to cope up with the demand for a continuous supply of water; the water in the well got exhausted within four hours and a sufficient interval had to be allowed for percolation, before pumping could be started again. Proposals were therefore contemplated to increase the water supply, either by deepening the well or by digging some more wells. As a preliminary to such deepening it was considered desirable to have an idea of the composition of the water of some of the wells in the locality and of the effect of such deepening on the concentration of salts. A start was made with three wells in the college compound, one of which was the hostel well itself; the analytical data pertaining to them are given below.

		Hostel well	Botanic Garden well (Parts per 100,000)	Well near the College building
Calcium bicarbonate	...	43·73	32·51	21·06
Calcium sulphate	...	2·40	9·46	5·37
Magnesium sulphate	...	15·45	8·54	1·92
Magnesium chloride	...	11·28	...	...
Sodium sulphate	...	...	35·79	39·17
Sodium chloride	...	70·96	52·50	28·91
Total of calculated salts	...	143·82	138·80	96·43
Total solids at 105° c	...	179·00	151·00	86·80

All the three wells are within a short distance of each other, the well on the south of the college being about 50 yards from the Botanic Garden well and the hostel well being a further 100 yards on the east from the college well, which is more or less midway between the two. It will be noticed that there is variation in the composition of water in the three wells, the Botanic Garden well being the worst in concentration, the sulphate and choloride of sodium accounting for about 70% of the total salts; the hostel well water also contained magnesium chloride and no sulphate, unlike the other two wells.

The next anhlysis undertaken was with reference to a number of *doruvus*'', which were found near the college sports ground. Near this area, plots carrying sweet-potato and millet varieties were laid and in the centre was a patch which was alkaline with white incrustation and where the crop growth was extremely poor. The analyses of six of these '*doruvu*' waters are given below.

		I	II	III	IV (Parts per 100,000)	V	VI
Calcium carbonate	...	...	1·37	...	1·37	2·46	2·73
Calcium bicarobonate	...	24·29	21·24	57·54	49·43	20·58	34·85
Calcium sulphate	...	...	...	3·30	40·19	...	4·37
Magnesium bicarbonate	...	9·54	16·74	...	...	8·85	...
Magnesium sulphate	...	6·51	...	28·58	..	9·08	21·08
Magnesium chloride	...	...	...	30·77	32·15	...	5·65
Sodium bicarbonate	...	...	4·5	...	...	...	...
Sodium sulphate	...	1·50	12·2	...	...	...	...
Sodium Chloride	...	19·04	23·65	55·73	64·06	20·77	62·88
Total of calculated salts	...	60·88	79·70	175·92	187·20	61·74	131·56
Total soluble salts	...	63·30	87·60	210·0	205·0	57·3	120·0

Once again it will be seen that sodium chloride is an important constituent; magnesium chloride was also found in varying amounts and the *doruvus* with the largest amounts of sodium and magnesium chloride (samples III and IV of table) were those found near the alkaline patches. Considering that the '*doruvus*' were near each other, (i. e., within an area of about 30 cents) the data showed much variation in composition, but it was found that the *doruvus* on the western side had a lower concentration than those on the east.

Following this, a number of '*doruvus*' and wells were examined outside the college area, in various parts of Bapatla town and the same observations were confirmed; viz., a wide variation in composition in wells within a short distance of each other, and the presence of magnesium chloride in varying amounts in the water of most of the wells.

In the meanwhile, the Industrial Engineer had been addressed to carry out boring trials within the college compound to locate, if possible, the most copious source of water supply. He started his work in the summer of 1946 and advantage was taken of his boring apparatus to obtain samples from different depths and to carry out analyses on them. Five spots within the college were examined.

I. Bore Trial: In the sweet potato plot near the students' hostel and close to the eastern boundary fence. (About 200 yards east of the college).

II. Bore Trial: On the eastern side of the pond near the dairy (About 150 yards E. S. E. of oollege).

III. Bore Trial: Near the college bus stand—(About 50 yards S. E. of college).

IV. Bore Trial: Near the gas house, (about 50 yards N. W. of the college).

V. Bore Trial: On the western side of the dairy pond (about 80 yards E. S. E. of the college).

At each spot a sample of water was drawn as soon as water appeared, noting at the same time the depth below ground level; thereafter, a sample was drawn for every successive 2 feet depth bored; up to a depth of 30'. In one of the spots (III) samples of soil were also drawn at every depth along with water, for later analysis. In all the spots it was noticed that upto the depth examined, namely 30', the soil was only sandy; no rock, either weathered or unweathered was noticed. Altogether 70 samples were examined and the results are presented in appendix 1. It will be seen from the figures, that in all the five borings, there is a sharp and sudden rise of total soluble salts, below a depth of 16 feet from ground level. Again magnesium salts increase in concentration,

only below this depth. Generally the upper layers (i. e., above 15′) contain 40 to 50% of calcium salts, O to 10 of magnesium salts and 40 to 50 of sodium salts.

The following conclusions are possible from the data presented: 1. It is not safe to go beyond a depth of 16′ feet in this soil, in an attempt to increase the supply of water. 2. The best place to locate a well is near the III Boring. As we go east or north, the salt content increases. In this boring, the total soluble salt content is the lowest, as seen from the comparative table below.

	Total Soluble Salts parts per 100,000 Appearance of water.	Content at 39' depth.
I Bore Trial	57	360
II Bore Trial	50	250
III Bore Trial	41	232
IV Bore Trial	46	390
V Bore Trial	110	280

In addition to this low soluble salt content, magnesium salts are very low in amount, the chloride being found only after a depth of 18 feet is reached. 3. A number of shallow wells, none of them deeper than 15′, would be the best way of providing an adequate supply of water for the college and the best place to locate these wells would be near the spot where the III Boring was made and all the wells could be connected together by a pumping installation.

In addition to the 70 samples from the above boring trials, samples from existing *doruvus*' were drawn in the new area proprosed to be acquired on the north-east side of the students' hostel. In these samples, the chloride content alone was determined, since the number of samples was large and it was felt that a complete analysis need not be taken up unless the chloride content warranted it. It was found that the amount of chlorides was abnormally high in all these samples indicating a correspondingly high salt concentration. It was felt that a boring trial in this area would not lead to the location of good water. The results confirmed further, the findings of the boring trial, namely that as we go farther and farther from the college in a north and an easterly direction, the salt content generally increases.

The presence of magnesium chloride in the Bapatla wells is characteristic. References* to literature show, that near the sea coast, tidal influence even through the soil layer has been known to affect the composition of water sources up to a distance of 15 miles—and it is possible that in Bapatla which is 4 to 5 miles from the sea, a similar

*The examination of waters and water supplies: (Thrush, Beal and Suckling, 5th Edition, by B. V. Suckling, 1944, J. & A. C. Churchill Ltd., London.

influence is exerted the consequence is the presence of magnesium chloride. There seems to be some justification for this for in the several wells examined, it was found that as we go further away from the sea, not only do total soluble salts decrease, but magnesium chloride is very low or completely absent. Amongst nearly 300 samples examined, the best water was found in a disused well in the new area proposed for acquisition for the college farm on the Guntur road. The analysis of that water is given as it is interesting: Calcium bicarbonate—13·72, sodium sulphate—24·10, sodium bicarbonate—4·10, sodium cholride—2 23. Total soluble salts—41·2.

With a total soluble salt content of only 41 parts per 100,000 with no magnesium chloride and very small amounts of sodium chloride, this well is unique amongst those examined in and around Bapatla. It is situated in a "*Pattimannu*" area and about 7 miles from the sea and a mile further off still, is a big drain leading from the Krishna canal. During the rainy months, most of the outlying area gets submerged under water.

Another well within Bapatla town, worth mention amongst those examined is the one in the taluq office compound. This also showed on analysis low total soluble salts (46 parts), low sodium chloride (22 parts), and was completely free from magnesium chloride.

PART II.

While the analytical data outlined above showed the best place to locate a series of wells for college supply and that it is not safe to go beyond a depth of 15 feet it was considered desirable to pursue the investigation and accumulate data, to have an idea of seasonal variations. It was not possible to do this in all the spots examined due to limitations of time, space and equipment in the laboratory. It was decided to concentrate on two chosen water sources within the college compound, draw samples every month and analyse them. For this purpose the hostel well and a pond near the college dairy were selected. The first sample was drawn from these on 24—2—1947 and since then 25 rounds of sampling have been finished up to date, the interval between any two rounds being roughly about a month. Care was taken to draw the samples on the same dates from the two sources.

The analytical data pertaining to these 25 rounds is furnished in appendix II.

From the data it is seen that:—

1. The hostel well water has a higher soluble salt content (130 –140 parts for 100,000) than the dairy pond (about 90 parts).
2. The hostel well water has a higher sodium chloride content (55 to 65 p. p.) than the dairy pond (30 to 45).

3. Calcium bicarbonate is also higher in the hostel well (40—45 p. p.) than the dairy pond (15 p. p. m.)
4. The most characterastic difference however is the complete absence of calcium sulphate and magnesium chloride in the dairy pond while the hostel well contains appreciable amounts of these salts, especially magnesium chloride.
5. Magnesium sulphate is also high in the hostel well water (25 p. p.) while it is either low or absent in some months in the dairy pond.
6. As against this, the dairy pond has appreciable amounts of sodium sulphate, which is absent in the hostel well.

The two sources are within a hundred yards of each other, but show such wide variations. While the hostel well gets periodcally pumped for supplying water to the college, the draw is not so great in the dairy pond, the water from which is taken by pots only, for the use of the dairy shed or for splash irrigation of the plants grown near by. It is possible that the hostel well gets its supply from deeper percolation, while the dairy pond which has a large surface area, gets its percolation water from nearer the surface. This might account for the difference in composition between the two waters.

It is also seen that while there is not much seasonal variation in both the sources, the hostel well water is more or less constant not only in its total soluble salts, but also in its calcium and sodium salts; on the other hand, the dairy pond is showing a tendency for a rise in concentration. It may be mentioned in passing that it has been the experience in Bapatla, that newly dug wells are sweet and used for drinking purposes, but gradually get saline with lapse of time. In the beginning they get their supply from surface percolation, and when this gets exhausted, a deeper spring is perhaps the source and this is influenced by the proximity to the sea. The dairy pond, which has so far not been used, is passing through a stage, when the salts are gradually increasing and will finally reach a constant figure. If a pump is also installed in the dairy pond, and the draw of water greater than now, this might result sooner. It is proposed to continue the analyses in monthly intervals for several seasons more to elucidate this aspect.

PART III

The work out lined in parts I and II referred mostly to the analysis of well waters either in or in close proximity to the College. The wide variations found within a short distance of each other required further intestigation. The Principal, Sri P. V. Ramaiah, suggested following up

the work with a study of the sand or any geological, strata at the bottom of the wells, in addition to analysing the water. With this object, a number of wells not only in Bapatla but as far away as Chinnaganjam were taken up for study.

Along with the drawing of water samples, samples of soil, or sand or weathered rock, found at the bottom of the well were also drawn for later examination. Below are given the analytical data referring to three well waters drawn from Chinnaganjam.

		Railway Station water supply reservoir.	A doruvu near the outer semaphore reputed to be, good water.	A newly excavated doruvu about 1 mile north of the Railway Station.
Calcium Bicarbonate	...	15·39	12·14	3·62
Sodium Bicarbonate	...	...	...	4·76
Sodium Chloride	...	12·69	9·94	9·48
		28·02	22·08	17·86

All the three wells were found to be extremely good, containing low total soluble salts, low sodium chloride and no magnesium chloride at all.

Chinnaganjam is an important watering station. for all trains on the main line, 25 miles from Bapatla. It is also on the sea coast and it is surprising that the water should be so good. It is however, on a different longitude from Bapatla which is more to the north east. As a matter of fact the sea has receded and Bapatla itself is on a curve of the coast line.

Samples of sand collected from the Chinnaganjam wells have been preserved for later complete chemical and mechanical analysis, but microscopic examination revealed an interesting feature. As in Bapatla no rock was met with in Chinnaganjam at the bottom of the wells, the soil being also sandy. But the sand of Chinnaganjam seen under the microscope, showed *smooth, rounded* and slightly coloured particles. The Bapatla sand particles on the other hand were angular, sharp and jagged and white in colour. The Bapatla sand seems to have been formed by the receding of the sea while the Chinnaganjam sand shows the erosive action of running water. A number of smooth, white flat pebbles collected at the bottom of these wells also shows this. Perhaps there is an underground spring located in the longitude of Chinnaganjam. When time and facilities permit, it is proposed to follow up this work by examining a number of water springs between Chinnaganjam and Bapatla. Included in this study, will be the analysis of waters for irrigation and drainage channels which traverse this area.

To Sri C. R. Sreenivasa Ayyangar the Principal of the College who first suggested this work, and to Sri P. V. Ramiah the present Principal, who has been giving valuable suggestions and guidance during the progress of the work our thanks are due. Our thanks are also due to the other assistants who have been helping us in the analytical portion of the work mentioned in the paper.

APPENDIX I

Depth in feet	Heads of Analysis; per 100,000 (to the nearest integer)								
	Ca $(HCO_3)_2$	Ca SO_4	Mg $(HCO_3)_2$	Mg SO_4	Mg Cl_2	Na HCO_3	Na_2 SO_4	Na Cl	Total
				No. I—Bore Trial					
10	16	12	...	5	6	...	...	9	48
12	16	...	...	...	...	...	16	15	47
14	21	13	...	2	9	...	...	20	65
16	41	15	...	8	17	...	...	57	138
18	40	3	...	19	4	...	...	74	140
20	46	4	...	10	...	...	12	88	160
22	53	17	...	19	21	...	...	90	200
24	54	12	...	39	25	...	...	133	263
26	69	...	4	39	40	...	...	130	282
28	77	10	...	57	35	...	...	141	320
30	75	...	...	67	17	...	...	196	355
				No. II—Bore Trial					
7	39	1	...	...	...	...	...	9	49
9	29	17	...	...	5	...	...	11	62
11	36	10	...	...	9	...	...	13	68
12	43	11	...	...	13	...	...	24	91
14	34	...	14	...	...	...	...	54	102
16	36	...	13	10	4	...	...	27	90
18	53	...	10	26	...	...	...	103	192
20	61	18	...	31	40	...	...	102	252
22	54	32	...	35	47	...	...	116	284
24	54	31	...	31	51	...	...	106	273
26	58	24	...	38	37	...	...	135	292
28	54	18	...	38	56	...	...	112	282
30	49	20	...	15	74	...	..	89	247
				No. III—Bore Trial					
5	28	...	...	...	...	4	...	9	41
6	30	...	...	...	...	4	...	9	43
7	32	...	...	...	...	3	...	9	44
8	22	...	...	...	...	...	...	12	34
9	34	...	...	...	...	...	...	19	53
10	25	...	...	...	...	...	...	18	43

APPENDIX I—*contd.*

Depth in feet	Heads of Analysis; per 100,000 (to the nearest integer)								
	Ca $(HCO_3)_2$	Ca SO_4	Mg $(HCO_3)_2$	Mg SO_4	Mg Cl_2	Na HCO_3	Na_2 SO_4	Na Cl	Total
11	22	...	...	...	...	16	7	44	89
12	24	...	...	...	...	18	12	43	97
13	32	...	...	...	...	13	14	51	110
14	31	...	10	...	...	...	10	55	106
16	44	...	12	20	...	...	8	55	139
18	52	...	9	28	10	...	...	86	185
20	49	...	10	26	10	...	...	89	184
22	52	...	11	27	18	...	...	82	190
24	49	...	17	28	12	...	...	90	196
26	49	...	20	28	7	...	...	95	199
28	50	...	12	32	...	...	21	104	219
30	56	...	8	39	9	...	...	120	232
				No. IV—Bore Trial					
5–7	20	3	...	...	...	...	...	23	46
7–9	20	5		...	...	...	...	25	50
9–11	23	...	...	...	...	8	3	25	59
11–13	49	14	...	13	16	...	..	83	175
13–15	36	12	...	13	13	...	...	40	114
15–17	56	21	...	38	28	...	...	70	213
17–19	56	28	...	31	36	...	...	22	173
19–21	56	21	...	28	19	...	...	42	166
21–23	57	...	...	45	...	...	22	60	184
23–25	53	3	...	56	17	...	...	145	274
25–27	42	20	...	48	11	...	...	176	297
27–29	41	17	...	54	15	...	...	203	330
29–30	49	19	...	63	11	...	...	173	315
				No. V—Bore Trial					
5–7	23	...	...	...	...	35	12	12	112
7–9	23	...	...	...	...	34	12	46	115
9–11	27	...	...	...	...	29	12	46	114
11–13	23	...	...	...	...	40	14	46	123
13–15	47	9	...	31	26	...	...	26	139
15–17	56	9	...	43	39	...	...	19	166
17–19	52	7	...	53	11	...	...	59	182
19–21	49	7	...	55	9	...	...	59	179
21–23	52	1	...	68	7	...	...	132	260
23–25	45	14	...	64	11	...	...	122	256
25–27	45	3	...	64	..	...	16	146	274
27–29	46	2	...	74	...	...	14	146	282
29–30	45	...	4	66	...	...	24	139	278

APPENDIX—II

Analysis of water samples from the Hostel Well and the Dairy well
Agricultural College, Bapatla.
Parts per 100,000 (rounded to the nearest integer)

Date of sampling	Ca $(HC_3)_2$		$COSO_4$		Mg $(HCO_3)_2$		Mg SO_4		Mg Cl_2		$Na_2 SO_4$		Na Cl		Total.	
	H.W.	D.W.	H.W.	D.W.	H.W.	D.W.	H.W.	D.W.	H.W.	D.W.	H.W.	D.W.	H.W,	D.W.	H.W	D.W.
24—2—47	44	9	2	absent	absent	13	16	2	11	absent	absent	..	71	27	144	51
2—4—47	48	9	6	,,	,,	11	9	..	12	,,	,,	11	63	35	138	66
1—5—47	39	11	7	,,	,,	13	11	...	21	,,	,,	9	49	27	120	66
2—6—47	57	20	...	,,	,,	13	13	...	10	,,	,,	11	57	59	137	133
4—7—47	35	14	2	,,	,,	17	10	...	4	,,	,,	12	56	45	107	88
22—8—47	43	14	...	,,	,,	5	5	...	...	,,	,,	15	81	39	129	73
29—9—47	49	20	8	,,	,,	3	16	14	13	,,	,,	6	80	32	166	75
27—10—47	37	20	14	,,	,,	3	7	14	18	,,	,,	6	62	32	138	75
30—11—47	35	20	16	,,	,,	11	3	13	26	,,	,,	9	49	52	129	105
5—12—47	36	21	15	,,	,,	2	5	17	21	,,	,,	...	56	40	133	80
20—1—48	50	17	7	,,	,,	14	11	11	13	,,	,,	9	46	39	127	90
23—2—48	53	18	10	,,	,,	6	3	4	21	,,	,,	18	63	42	150	88
19—4—48	47	15	6	,,	,,	4	16	11	2	,,	,,	10	68	51	139	91
21—5—48	45	8	11	,,	,,	...	8	17	12	,,	,,	11	56	31	132	67
30—6—48	55	17	5	,,	,,	4	38	3	...	,,	,,	30	88	76	186	130
5—8—48	49	16	10	,,	,,	..	...	...	...	,,	,,	10	77	57	136	83
9—9—48	36	26	18	,,	,,	...	...	...	...	,,	,,	23	68	62	122	118
9—10—48	45	21	10	,,	,,	...	14	...	15	,,	,,	21	63	52	147	116
2—11—48	42	14	6	,,	,,	...	12	...	11	,,	,,	22	63	55	134	105
2—12—48	39	17	1	,,	,,	...	11	...	20	,,	,,	22	51	40	132	98
31—12—48	45	22	6	,,	,,	15	28	...	...	,,	,,	39	74	44	153	121
31—1—49	40	14	4	,,	,,	22	17	7	7	,,	,,	14	61	50	129	107
28—2—49	42	13	6	,,	,,	24	18	...	43	,,	,,	17	18	54	127	98
31—3—49	43	11	10	,,	,,	29	21	...	9	,,	,,	23	70	83	153	146
2—5—49	38	11	7	,,	,,	31	16	...	7	,,	,,	24	37	73	105	143

"How facts flow to farmers in U. S. A."*

By

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I. **The role of the universities:** The Universities in North America are important centres of activity for both agricultural research and the transmission of results of research to the farmer. Between the farmer and the university, there is a two-way traffic, with the farmer taking his problems to the university and the university contacting the farmer with the solution to his problems. The College of Agriculture, of U. S. universities is organised with three main functions: (1) Resident instruction in agriculture. (2) Experiment station and research work. (3) Extension service, which is the propaganda section as we call it in India. Resident instruction provides for major specialisation in agriculture and in its numerous allied fields. The Experiment stations are the means through which many contributions to a more productive and pleasant farm life are made. The Extension service, including its staff of county agricultural agents, home extension agents and club agents, which are their equivalents of our agricultural demonstrators, disseminates the information derived from the Experimental stations and College laboratories.

(1) *Resident instruction*: In the Michigan State College, which is the oldest agricultural college in the U. S. A., there were in 1948 1,085 students working for their Bachelors degree in agriculture, 190 postgraduate students and 743 students undergoing short courses. These short courses form an important part of the college activity, being designed to give every type of farmer or his sons and daughters an opportunity to keep abreast of the latest developments in his type of farming. They provide a variety of courses running to 200 and more, to suit every type and branch of farming, lasting from a few days to two years' duration, according to the needs of the student or farmer.

(2) *Research*: There is no need to emphasise here the quality and quantity of agricultural research in U. S. A. Given the same equipment and facilities as exist in the U. S. A., agricultural research workers in India can also produce as much results as American scientists and can place India definitely on a position of prestige in research. One other reason for this attainment of research is the spirit of camaraderie that exists between the American research worker and the farmer. The research worker in American U iversities is on such close terms with the farmers with whom he deals that he keeps his researches abreast with the farmers' problems. This is helped not only by the direct contact of the research worker with the farmer but also by an intimate liaison with the Extension service which forms a part of the University.

* Paper read at the 32nd College Day and Conference.

(3) *Extension Service or Propaganda*: The extension work in many states covers both Agriculture and Home Economics and is a co-operative enterprise carried on by the universities, the United States Department of Agriculture and the countries of the State (which are comparable to the districts of our province) but entirely under the supervision of the University. This Extension Service reaches every county and township (which is comparable to our villages) through the county agents who are *specialists in agriculture, home economics* and *youth training*. In U. S. A., the farmers' home is treated as an economic unit and the farmers' children as the future generation of scientific farmers. It is the corner stone of the agricultural propaganda in America that the farmer and his home must be planned and managed in harmony to produce effective results, without which agricultural improvements will never get "down to the earth". This is the reason why there is so much of home economics in every American university, always allied with agriculture.

Further, specialists and demonstration agents can achieve little by themselves unless there is a local rural leadership to co-operate and this is the basic reason for the county agents also to be specialists in *youth training*. In fact, the farmers and home-makers are mainly reached by the specialists and demonstration agents through these local leaders. In Michigan, in 1948, for instance, leadership training meetings numbered nearly 2,000 with more than 30,000 local leaders taking part and carrying information back to their townships.

(4) *Work of some of the departments in the College of Agriculture*: A few instances may be mentioned here of the types of work carried on by the research departments in the universities, to see that the farmer gets what he needs in time. Every year the farm management department analyses hundreds of farm business records to advise the farmers on the economic trends of farming. In 1944, anticipating a back-to-the-land movement following the war, this department in the Michigan State College, provided information to guide ex-servicemen, industrial workers, and others, considering farming as a vocation. The Dairy Department in the same college developed a programme of state-wide artificial insemination of cattle, in co-operation with the Michigan Artificial Breeders' Association and in the very first year, 1945, 20,000 cows were successfully inseminated. The Agricultural Engineering Department of the same college introduced recently a mechanical sugar-beet harvesting equipment, and what can perhaps be described as a field-size "Vacuum Sweeper" for harvesting seeds and seed-heads of crops that lie on the ground, by sucking them up with the help of a motor-driven fan and by collecting them in a large canvas bag for subsequent threshing and cleaning. One of the usual features of the Agricultural Engineering Department is the constant remodelling of farmers' homes.

(5) *The Public Relations Department*: Here we come into a characteristic feature of America, of specialisation in publicity, based on the principle that the people should know as much as possible, to make them efficient farmers, and citizens. Each university has a public relations department whose duty is to supervise and turn out publications of all kinds, from the most scientific, to the most popular so as to suit all types of readers. This department also makes the best use of audio-visual aids to convey information and takes every care of the visitors and invites visitors who are interested. Such a department in the university does very useful work for the agricultural college and an evidence of the intensity of work are the numerous leaflets, bulletins and magazines, that are sent out regularly every now and then, and with which the members of the Madras Agricultural Department are so familiar. In 1948 at the Michigan State College, 112 new Extension Service Publications were produced and nearly a million copies distributed from the Bulletin office. More than 1,300 different information stores were released to Press and Radio outlet during the year. Manning this department are personnel highly trained in the various branches of literary work, printing, publishing, photography, audio-visual aids etc.

(6) *University contacts with the farmers*: The universities with agricultural colleges are so anxious that the farmers should visit their agricultural departments and see what they are doing, that they organise annual events for the farmers. At the Michigan State College, I had the privilege of attending a Farmers' Week in 1948, conducted by the university, which was attended by 30,000 farmers; and which gave the rural people of Michigan short courses in new ideas of farming and home making. There was an Annual Farmers' Day and 4-H Club show in August, which attracted whole families of farmers.

II. **The role of the Government**: (a) *The State Government*: While the work of the State Universities detailed before is the concern of the State Government, each state has also the State Department of Agriculture and the State Department of Conservation. With the help of the State Soil Conservation Committee, ways and means are found of taking to the farmer's door, demonstration and information on soil conservation. Besides this, many states have Land Use and Zoning Acts to prevent unwise use of the land, especially lands of low fertility.

(b) *The Federal Government*: The farmer is so important to the Nation as a whole that his problems are of national concern to the American Government. The agencies of the U. S. Federal Government for helping the farmers are too numerous to mention but just a few important aspects of this work may be given. One of the most important features of Federal Service to the farmer is that whatever the type of help given to the farmer, it is almost invariably accompanied by

recommendations for improvements, such as greater emphasis on appraisal, farm management, auditing, statistics, research and information and education services to the farmer.

(1) *The U. S. Department of Agriculture*: This department is the largest agency of the Federal Government, having numerous activities, some of which are listed below:

(a) *The Bureau of Plant Industry, Soils and Agricultural Engineering, Beltsville, Maryland*: This is the most important branch of U. S. Department of Agriculture, with field locations for research spread all over the states and in ten Latin American countries, and co-operating with State Experiment Stations of 44 states, and having a 14,000-acre agricultural centre. It is significant that included in its four main lines of work is "Designing farmhouses and other farm buildings that make for comfortable living and profitable farming". The Burean has also one of the best publicity departments of U. S. A., issuing leaflets and bulletins in thousands, taking care of innumerable visitors and specialising in visual aids for conveying information to farmers.

(b) *Bureau of Agricultural Economics*: This is a federal research agency of the U. S. Department of Agriculture, to collect, analyse and interpret production, economic and social information affecting agriculture; to act as adviser to the Secretary of Agriculture and to agricultural committees on national policies and legislation. The staff is located in Washington D. C., and in each state, while the agricultural specialists are at the agricultural colleges. It prepares many hundred publications each year, including special reports on commodities, research bulletins, a monthly check list of publications, all used by trade, farm organisations and the agricultural colleges.

(c) *U. S. D. A. Market News Service*: This agency collects and reports information on the volume and prices of livestock and agricultural produce and prepares reports for distribution to press, radio and to individuals.

(2) *U. S. Soil Conservation Service*, furnishes help and information regarding the soil practices, contour farming and strip cropping etc.

(3) *The Rural Electrification Administration*, another agency of the Federal Government, aims to bring more and more farms every year under electrification and informs the farmer of all the progressive uses that electricity could be put to in a farm.

(4) *The Tennessee Valley Authority*. What the T. V. A. has done to revitalise the American farmer with all that is modern in research, is a story that would belong to a seperate chapter. But, it is of importance

to mention here, about the test-demonstration farms used as an educational device, at the Tennessee Valley region for achieving the agricultural development of that region. In June, 1946, there were 38,800 of them in active operation. Through the test-demonstration farms, practical farmers can learn through their own action and by observation, the methods and benefits of proper application of soil minerals and of altered farm practices and farm management. In this way, the neighbours of test-demonstration farmers can see actual results. The demonstrations are of two types. One is the "Unit" test demonstration farm, in which individual farmers, usually selected by their neighbours, test and report on results of new methods in farming operation which are planned by the farmer with the help of his county agent. The other is the "area" demonstration in which entire farming communities participate. In such communities, agricultural developments becomes a co-operative effort and leads usually to a quickening of the community spirit and community life. These test demonstration farms have been copied in several states of the nation, by Experimental Stations and Extension Services so that today three million acres are under test demonstration farms. Such test demonstration farms would be very useful under Indian conditions also, as they produce a new pattern of farming which develops and utilises most effectively the natural resources of water, soil and crops, the capital resources such as buildings, fences, power, machinery, equipment; the farm family resources such as labour, skills and knowledge; and community resources such as marketing, distribution and processing facilities, churches and schools. This development is essential in freeing the farmer from the limitations of poor land, lack of power, machinery and livestock, inefficient agricultural practices, and limited skills and a narrow outlook and in opening the way to an effective democratic way of life on the farm and in the farm community.

III. **The role of the Press and the Radio**: While the national magazines and newspapers continuously feature topics for the farmer, the Community Press, as it is called, is the most influential in getting to the farmer the latest in farming developments. Every township or a small group of township run their own dailies, featuring news for the farmer. Besides this, papers like the Hoard's Dairymen at Wisconsin, play an important role in educating the farmer. The Hoard's Dairymen has a wide national circulation and has an editorial staff of nine specialists who seek the latest findings of the agricultural colleges. The managing editor of the Hoard's Dairyman, Mr. A. J. Glover, runs a practical 200-acre dairy farm, just to be sure of what he says in his magazine. Besides these are the numerous agricultural monthlies, run on popular lines. The radio also plays its tremendous part, and many of the universities with agricultural colleges own broadcasting stations from which are beamed forth information for the agriculturists and warnings about weather, pests and diseases, day in and day out.

IV. **The role of the 4 H-Club:** This is a well-known club for the sons and daughters of farmers, who are to be trained as the future farmers of America. The movement is one of the great contributory causes of the continued prosperity of the American agriculturist. The number of projects that are tackled by these youngsters in raising the best crops, fruits, vegetables, poultry and livestock under competition, with the guidance of the county agents and the enthusiasm with which the boys and girls take to these projects is astounding. What happens by way of introduction of the latest methods of agriculture to the children of the farmer cannot be easily ignored by the farmer himself. The 4 H-Club has contributed so much to the progressiveness of the farmers that the County Boards of Michigan last year, voted a total of 300,000 dollars (10 lakhs of rupees) to the programmes of the 4 H-Club. A great youth movement, it reached 60,000 boys and girls from ten to twentyone years of age in the one state of Michigan alone. The Agricultural Extension Service, is closely knit with the 4 H-Club.

V. **The role of private enterprise:** There are numerous large industries depending upon agriculture as its raw material and in all these cases, the industries establish special departments of agricultural research to help the farmers. The Gorber Products Company, the largest baby food plant in the world situated at Fremont in Michigan, is an example. This company processes a great variety of fruits, vegetables, soups, meats etc., for children and it has a department of agricultural research to obtain quality products. The International Harvester Co., which manufactures and distributes a wide variety of farm machinery in the U. S. and foreign markets, uses literature, films, exhibits, and demonstrations not only to sell their products but also to increase farm efficiency and farm income and to save labour and energy in form operations. Swift and Co., in Chicago, the largest meat packing concern in the world has one of the largest departments of agricultural research for any private company in the world and by direct contact with their farmers, see to it that the results of research are assimilated into their practices. The Dow Chemical Company, one of the largest of its kind, publishes magazines for farmers to keep them informed of the latest developments in the application of plant hormones and chemicals to agriculture. Kellogg, the manufacturer of the famous Kellogg's Corn Flakes and breakfast cereals has established what is known as the Kellogg Foundation, worth nearly 50 million dollars, most of which goes towards increasing the welfare and efficiency of the farmer. In addition to these, there are several private institutions, entirely supported by private funds for research in agriculture and plant sciences and with an organisation to see that the results actually reach the farmer. The Boyce Thompson Institute at Yonkers, New York, with Dr. Zimmerman, the wizard of plant hormones, is a great private institution whose contribution to American agriculture is significant and very widely known.

VI. **The role of the farmer**: (a) *Farmers' organisations*: The role that the farmer himself plays in keeping abreast of the results of agricultural research is almost incredible. The organisational capacity of the American farmer, in the interest of his group is astonishing. In Michigan alone, which is comparable to a province in India, there are 23 Livestock Associations, 6 Dairy Cattle Associations, 9 Dairy Produce Organisations, 10 Poultry and Rabbit Organisations, 4 Farm Crops Associations, 5 Agricultural Engineering Organisations, 4 Muck Farmers' Associations, 1 Farm Management Association, 1 Soil Conservation Association, 12 Horticultural and Floricultural Organisations, and 18 Agricultural Economics Organisations, making a total of 96 different agricultural organisations to take care of different interests. This is apart from 2 Forestry Associations and 6 Veterinary Medical Associations which are treated very often in America as part of Agriculture. The aim of all these organisations, is to get the best out of research in their fields, from whatever source it is available, so as to keep continuously modern and efficient in production and marketing methods. They invite speakers to their groups, welcome demonstrations in their fields, organise trips for their members to colleges, research centres and private farms run on scientific lines, hold exhibitions and publish their own magazines or information bulletins, pool their resources to persuade the government to enact beneficial laws in times of need or to cancel enactments that would harm their industry.

Of all the agricultural organisations, the general trend of the co-operatives is the most encouraging feature of American agriculture. The best examples of such co-operatives are the California Fruit Exchange (deciduous fruits) and California Fruit-Growers' Exchange (citrus). These exchanges are grower-owned, co-operative marketing organisations, and they own and operate numerous packing houses, located in every fruit district of California, and several by-product industries and they bring to the growers the latest in methods of production.

At the national level, there are organisations to take care of the interests of the whole group of farmers of the nation. The American Farm Bureau Federations was organised in 1919 to "represent the business, economic, social and educational interests of the farmers of the nation and to develop agriculture". It publishes a magazine called "Nation's Agriculture". It has been responsible for many legislative measures of the Congress to benefit the farmer. The National Council of Farmer Co-operatives is a public relation and legislative agency for the farm co-operatives and prepares materials for distribution to members as "Washington Situation", a weekly release, and represents members at legislative hearings as a voice of organised agriculture.

***The farmers' aptitude for research and his promptness in application of results*:** Most of the American farmers have an interest in research and this is one of the contributory causes to American efficiency in agriculture. They are themselves often trying and evolving new practices and forcing the Experiment Stations to keep ahead of them. The California Citrus Industry is a tribute to the pioneering spirit of the citrus growers of California. The famous Henry Wallace is a practical farmer of Iowa and was one of the persons responsible for the development of Hybrid Corn, which has revolutionised agriculture in the mid-west regions of the U. S. A. The American farmers are also quick to seek and adopt results of research. Artificial insemination for cattle breeding, the general use of chemicals and plant hormones, the spraying and dusting for pests and diseases by aeroplane and the highly mechanised agriculture are all examples of the receptivity or the American farmer to progressive ideas.

What we can do in India: Briefly, the reasons for the very successful education of the American farmer, are the following:—

(1) Between the research worker and the farmer, there is a comradeship, made possible because of the high educational level of the American farmer.

(2) The American policy of agricultural research reaching the farmer is to treat the farmers' family as an economic unit on the basis that only if the family is prosperous can there be a question of the farmer carrying out improvements.

(3) The American policy is not to be satisfied with the efficiency of the present generation of farmers but to ensure also that the future generations keep up their efficiency with the times.

(4) There is a conviction that the Extension Service (i.e. Propaganda division) cannot by themselves achieve much, unless there is local leadership to assist. Hence the American emphasis on leadership training as the cornerstone of Extension policy.

(5) The Press in America has realised the importance of the farmer. The Community press to serve the farmers is a feature of American agriculture.

(6) The Radio is equally of service to the farmer by keeping him posted with up-to-the-minute developments.

(7) The Private Industries which thrive on agriculture in America attempt to return the debt they owe to the farmer.

(8) The American farmer is well-educated, modern and well-organised, so that he can produce and market efficiently.

(9) Lastly, the Americans are experts in publicity and they leave no stone unturned to see that the information they have, reach the farmer. In this, the latest methods of visual aids are a great feature.

From all this it is evident that we cannot entirely duplicate the results of America in India, because the Indian farmer is not on the same educational level, to be receptive to developments to the extent that we would wish, and to organise himself to develop as a group. Education and organisation of the farmers should be the keystone of our agricultural policy. That a whole generation of farmers cannot be made overnight to read and write is not a matter of despair. Audio-visual aids come to our rescue and if these aids are properly used and if men with ideas are utilised to develop the material required in script and presentation, there is a tremendous possibility. Besides this, the Indian tradition is so full of village dramas, rural folk songs and dances that we can utilise them to the advantage of the former. As far as organisation of the farmer is concerned, training of local leaders becomes a matter of utmost importance —leaders who are trained to be scientific farmers, and who are respected by the local community.

Deficiencies of minor elements responsible for diseases of crop plants in this province*

By

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Crop plants remove considerable amounts of mineral nutrients from the soil during their life. A small percentage of these may be returned to the soil by the disintegration of those parts left in the soil. But the major proportion contained in stem, leaves, fruits and seeds does not come back at least to the same place. Consequently replenishment of the loss is necessary. For this purpose manures have to be applied to the cropped areas. Knowledge of the nutritional requirements of plants have undergone change in recent years. At one time it was thought that the plants were in need of only ten essential elements for growth. Recent work especially during the last three decades has however resulted in the development of our knowledge of the part played by various other elements in the life of the plants and has led to the addition of more elements under this category. These later additions are usually termed as "minor elements" "trace element" or "micronutrients" and have been found to be equally essential though they are required only in extremely small quantities. Though the role of these elements fall within the realm of physiological studies, the absence or deficiencies of these elements lead to the development of pathological symptoms of crop plants

* Paper read at the 32nd College Day and Conference.

and these are of considerable interest to the plant pathologist. Furthermore there is more information of the pathological aspect of these trace elements than their physiological functions.

In our province a certain amount of investigation of the pathological aspect of some of these elements has been made by the mycology section and the results are included hereunder.

One of the trace elements whose deficiency has been exhibited by disease symptoms in plants is boron. During the World War II intensive cultivation of vegetables was undertaken on the Nilgiris for the benefit of the army. Extensive areas were under turnip, beet root, cauliflower and cabbage. The turnips, beet roots and cauliflowers grown in some localities near Ootacamund developed certain pathological symptoms. The core of the root in turnip was soft and presented a discoloured water-soaked appearance (water core) instead of being white and hard. In beets the crown was often found rotten, blackened and the young leaves at the top were also involved. The cauliflowers in some fields did not develop the normal creamy curd but had poor flowers of varying shades of brown. Pathogenic organisms were not present in the affected portions. Similar symptoms on these crops have been described from other countries as being caused by boron deficiency. The only way to test this was by supplying the deficiency. With the co-operation of one of the leading ryots of Ootacamund, field experiments were conducted for over two seasons, for the control of water core of turnips. Boron was applied to the soil in the form of boric acid a few days before sowing at the rate of five, ten, fifteen and twenty pounds per acre. Spray inoculation of a 0·2 percent solution of boric acid on the foliage was also tried. An examination of the tubers from the various plots showed that all the treated plots had very little or no symptoms of the disease and that spray application was as effective as application to the soil. Thus it was proved that boron deficiency was responsible for the symptoms of water core of turnips. Based on these experiments the ryot was advised to broadcast 5 pounds of boric acid per acre. It is also concluded that the pathological symptoms observed on beet roots and cauliflower must be due to the same cause, and boric acid application will be beneficial.

Boron deficiency affects growth of many other crops also. Excess of boron is however toxic to plants and this has to be borne in mind in recommending the dosage of the element to be applied.

Zinc is another minor element whose deficiency in the soil or non-availability to the plant is evident in many parts of the province. Orange trees in several districts of the plains exhibit symptoms of zinc deficiency. The growth of the tree is arrested. The leaves develop yellow blotches between the veins presenting a characteristic mottled appearance. The leaves become progressively smaller; fruits are produced and in course of time the tree deteriorates and falls a prey to other pathogens.

There are two ways of supplying this deficiency, either by application of zinc sulphate to the soil or by the spray application on the foliage. Addition of zinc sulphate to the soil was done by placing it in holes 9 inches deep all round the tree or by broadcasting the salt over the soil round the trees and working it in. Both these methods failed to produce any response in the trees. The spray application was next tried. The composition of the spray fluid was varied according to the intensity of symptoms. In trees which had initial stages of deficiency symptoms zinc sulphate-lime mixture of the formula of 5 – 2½-100 was used and in more severe chronic instances the formula 10 – 5-100 was followed. Zinc sulphate was dissolved in water in one vessel. In another bigger vessel the lime was slaked and later diluted with the required quantity of water. The zinc sulphate solution was poured into the lime solution and stirred. The resulting mixture was sprayed on the foliage. The best period for spraying is when the trees are putting forth new flush of leaves. Two applications are necessary in a year and these can be adjusted with reference to the flushing period in each locality. It is better not to spray when the trees are in flower. Experience in America and in our Province has shown that there is no harm when the trees with fruits on are sprayed provided the mixture is correctly prepared (neutralised). The response is much quicker when the spray is made on young foliage than on old ones. Application of large quantities of farm yard manure in addition to the spray will also be beneficial. Zinc salts may be present in the soil but do not become available to the plants and that is the reason why soil applications do not produce any response. The results of these experiments have been given wide publicity and several orange growers are regularly spraying the trees with zinc sulphate. The department had arranged to distribute over 5 tons of zinc sulphate in 1947 and larger amounts are being used at present.

Another minor element whose deficiency has been found to produce pathological symptoms is copper. Citrus plants readily exhibit the deficiency of this element. The disease known as 'Exanthema' or 'one form of die back' is due to this. In the initial stages of copper deficiency the young branches are frequently angular and 'S' shaped with multiple buds instead of being round with usually one bud as in normal plants. In acute stages the twigs begin to die back and gum pockets develop at the leaf bases. The branches may be covered with brown gummy excrescences and ultimately defoliation takes place. The rind of the fruit also may exhibit hard brown excrescenses.

Spraying the trees with Bordeaux mixture has resulted in marked response and the disappearance of the symptoms. Bordeaux mixture is sprayed on orange trees for protection against several diseases and this treatment serves also for making good the copper deficiency. Copper sulphate can be applied to the soil also with good effect about half to two

pounds per tree being used either separately or mixed with other fertilizers. It is common experience in many orange gardens that by spraying Bordeaux mixture the production has been increased even in the absence of fungal diseases. It should however be mentioned that the "die-back" caused by lack of copper should not be confused with the one caused by other causes like root damage, shallow soil over hard pan, poor drainage, over irrigation etc.

For some years past a decline of orange trees has been prevalent in the submontane tracts of Shevaroys, Kotagiri and Coorg. In Kukal and Shevroys, mottling and chlorosis of the leaves become apparent and gradual defoliation results. At first it was thought that this might be due to deficiencies of zinc or iron. Experiments were conducted at Yercaud to note the effect of spraying the foliage with zinc sulphate, iron, sulphate and manganese sulphate individully and in combination. But there was very little response.

In Kukal valley also it was surmised that the trees were not getting all the nutrient requirements. The soil from the base of the affected and apparently healthy trees were analysed with the help of the Government Agricultural Chemist. The figures showed that the soil in the neighbourhood of the diseased trees had less of phosphorous. The response from the application of this manure was reported to be incomplete.

It is now known that diagnostic soil analyses for trace elements have been little developed. Visual symptoms of mineral deficiencies exhibited by plants especially orange, sometimes overlap and it is sometimes difficult to state what particular element is wanting from these symptoms. In such cases one has to try cultivation of indicator plants or resort to plant analysis. The latter method has been recognised as a quicker and reliable method and in the present day the composition of the plant tissues as revealed by plant analysis is known to give a correct picture of the nutritional status of the plants. The analysis of the plant material can be made either by the usual time-consuming laboratory method or by the spectographic method.

It was thought that the spectographic analyses of leaf samples of equal age from the diseased and healthy plants from Kukal may give a correct picture of the situation. With this idea Dr. Patwardhan, Director of the Nutrition Research Laboratories, Coonoor was approached to extend his co-operation as he was in possessions of a spectrograph. He readily consented to give all help.

Representative samples of the leaves were taken from the garden of Mr. N. B. Athrey of Kodeneri Estate and he was very enthusiastic in

rendering all help in solving the problem. With the kind help of the Government Agricultural Chemist the samples were converted into ash and taken to Coonoor for the analysis. Dr. De the assistant chemist, helped in the analysis. Several readings were made. It was clear from the spectrograph that the leaves from diseased plants had deficiencies of several elements when compared to healthy ones. Zinc was absent in all specimens. The leaves from affected trees exhibited deficiency of phosphorous, magnesium, manganese and boron whereas no differences could be made out between the two with regard to calcium and iron.

It is clear from the analysis of the leaves that the trees are lacking in several nutrients. There is agreement between the soil and leaf analyses in the matter of phosphorus. But the deficiencies of manganese, boron, magnesium and zinc (in all cases) which have been revealed by the leaf analysis could not be easily made out in soil analysis. Furthermore the minerals may be present in the soil but may not be available to the trees. Citrus trees are known to grow well at pH 7 but very often the nutrient substances do not become available to the plants from the soil at this reaction. The soil at Kodeneri estate was found to have a reaction in the neighborhood of pH 7. Moreover lack of boron has been reported to inhibit absorption of phosphates from the soil. So it is quite possible that the trees are not able to obtain their requirements from the soil due to these causes.

In Florida where deficiencies of various elements have been observed in orange gardens a new technique is being employed for replenishment of the nutrients, i.e., by spraying a combination mixture of phosphorus, potassium, maganesium, manganese, boron etc., instead of applying these to the soil for quick response. It has been decided to try this method at Kukal. Mr. Athrey has agreed to place his garden at our disposal for the conduct of these experiments and we thank him for it.

The usefulness of leaf analysis in determining the nutritional requirements of crop plants is brought out by these experiments. This method of tackling some of the diseases has been attempted for the first time in this province not only in the case of orange but also in the case arecanut, A spectrograph however is essential for this type of work as one cannot be always troubling other institutions for this. I understand that sanction has recently been accorded for purchasing one for this institute. Various undiagnosed troubles without any associated pathogens occur in many crop plants and fruit trees e.g., areca, orange, plums, vegetables etc. The analyses of plant parts may often help in solving some of these problems and a quick and efficient method of doing this is by the spectrographic analysis.

Summary. Several pathlogical symptoms caused by deficiencies of minor elements have been observed in this province. Boron deficiency causes water core of turnips and crown rot of beets on the Nilgiris. Mottling of orange leaves due to deficiency of zinc is prevalent in many districts. 'Exanthema' of citrus is caused by copper deficiency, Methods of supplying these deficiencies are described.

Recently a decline of oranges in Kotagiri, Yercaud and other hilly districts has been attributed to deficiencies of several elements including zinc, manganese and boron. This was revealed by spectrographic analysis of plant tissues with a view to obtain a correct estimate of the nutritional status of the plants is stressed.

Gleanings

The peasant and the commisar. An analysis of Russian agricultural policy: For 32 years Russia has been attempting to convert agriculture into an industry on the same lines as the heavy industries. In the plan, control of all farm production was to be centered in Moscow. Workers were to be regimented in the same way as factory hands and miners. The experiment has not succeeded even to the small extent achieved in other industries. According to the "Soviet Encyclopaedia", Lenin, in 1919, wanted to encourage the small farmers to join co-operatives, i. e. groups in farmers help each other by lending implements, machinery and (sometimes) workers. Most small farmers had no objection to this scheme; it helped them by opening up marketing co-operatives as well. Afterwards, if the plan worked, they were to be plunged into collectivisation (i. e. communisation in which the State owns all implements, equipment and cattle). This was known as "Lenin's Co-operative Plan". Its ultimate object, however, was not "co-operation" as such, but the complete submerging of agriculture into the Soviet economic plan. Large landowners had been liquidated, the Kulaks (independent farm owners) were necessary for the time, because of their experience. Peasants, who formed the major part of the producing farmers, had to be encouraged.

Stalin impatient: Stalin, on the other hand, was more impatient. In an essay "Problems of Leninism" written in 1926 he discussed an alliance between the labouring masses and the peasantry, and wrote: "This special form of alliance consists in that the guiding force of this alliance is the proletariat. This special form of alliance consists in that the leader of the State, the leader in the system of the dictatorship of the proletariat, is one party .... the party of the Communists, which does not and cannot share that leadership with other parties. In fact, the alliance is of the nature of the relationship between officer and man". The Russian peasantry of 1926 was, therefore, in the position of having been manoevred into bringing in the new "officers" to replace the old landlords. The main difference was that the "officers" were controlled by the central Party in Moscow. The fifteenth Party Congress in December 1927 adopted a resolution for "positive measures to be taken to collectivise peasant farming". These measures included the abolition of the Kulaks and controlling of agriculture by thousands of bureaucrats drawn from the proletariat. By November 1929, more than 25,000 city workers had been sent to the country to organise farms on Stalinist lines. Their duties were political but they became virtually "bosses of the peasantry".

In December of that year Stalin delivered a speech at the "Conference of Marxist Students". In it he said: We have passed on to a policy of eliminating the Kulaks as a class. In this way the independent farmer was to follow the large landowner into "liquidation". The decree to put this into effect was published in January 1930. It provided for the expulsion of the Kulaks from their territories and the confiscation of their houses, cattle and machinery. In that winter alone, 500,000 Kulaks were exiled — many of them to far Eastern Siberia where they worked as slave-labourers in the mines or in the lumber camps. During the following two years, that is, until 1932, a total of 2,000,000 Kulaks and better class peasants, followed the same route to the death camps.

In this way agriculture was denuded of its most efficient members. The remainder were inefficient and, therefore, prepared to fit in with the government scheme of full collectivisation. Controlled by the bureaucrats, they failed to produce sufficient food for the winter 1932-33. A famine which was most severe in the Ukraine and in Southern Russia, was the direct result.

"Capitalistic" concesssions: The Kremlin, realising this, was forced to make some major concessions. In the towns, free markets for farm produce were re-introduced. Collective forms as a whole, and individual farmers, were allowed to market any grain left over after they had handed over their state quota. The delivery of quotas was amended. The Kremlin had, therefore, been forced to retreat a little towards a state of "capitalism" in production and trade. It had, in fact, admitted the failure of the attempt to impose the Stalinist policy on farming. That was in 1935 ;but the position is the same today. The peasantry, although collectivised to a considerable extent, is still far behind the heavey and other industries in "communisation". The farmers, however, still operate under bureaucracy with control centralized in Moscow.

The inefficiency of the bureaucrats and the apathy of the farm workers have prevented any real progress. In fact, comparing the small improvement in output with that achieved by modern methods in other countries the Soviet's 30 years of experiments can be considered a failure. In Great Britain the agricultural output for 1948 is three times that of 1938.

In some parts of the Soviet Union, noticeably in the Ukraine, there are collective farms which have been a success. These form a "shop window". Well cultivated land, comfortable houses, tractors and other agricultural machinery, and well-fed farmers do useful service in impressing foreign visitors; the latter are never allowed to get a glimpse of farms that would give a true picture of the general state of Soviet agriculture.

The same propaganda methods are used in other industries and undertakings. In the Dalstroy area in far Eastern Siberia, for instance, the capital, Magadan, is merely a facade behind which nearly a million slave labourers die a slow death. In the "corrective-labour" camps near Moscow the "educational facilities" are demonstrated. These, too, hide the brutality and inhumanity of the M. V. D. (secret police) system. The collective farms in the Ukraine and Southern Russia are momentoes of the 2,000,000 liquidated Kulaks and peasants. Like Stalin's statement in January 1933 they are the beautiful lies behind which the bureaucrat-ridden peasants plod their weary way (British Information Services).

Crop and Trade Reports

Statistics — Agricultural — Cotton — Additional forecast report 1948 — 49. The area under Cotton in the Madras Province in 1948—49 is estimated at 1,500,800 acres as against 1,360,900 acres estimated for the corresponding period of the previous year. The present estimate for the Province represents an increase of 19·0% as compared with the finally recorded area of 1,307,565 acres in 1947—48. The increase in area in the current year as compared with the previous year occurs in all the districts except East Godavari, South Arcot and Malabar where there is a slight decrease. The increase is marked in the districts of Guntur, Cuddapah, Kurnool, Salem, Coimbatore Tiruchirapalli and is due mainly to the increase in demand for cotton. The main or first picking of cotton is over in all the districts. The yield per acre is estimated to be normal in East Godavari, West Godavari, Krishna, Guntur, Malabar and South Kanara and below the normal in the other districts of the province. The crop had a set back due to insufficient rainfall in Guntur, Anantapur, Cuddapah, North Arcot and Salem districts. The crop was also affected to some extent in parts of Bellary and Anantapur by attack of insect pests. The seasonal factor for the province as a whole works out to 88% of the average for both the irrigated and unirrigated crop, the corresponding figure according to the Season and Crop Report for 1947—48 being 82 percent. On this basis total yield works out to 341, 500 bales of 392 lb. in lint as against 272, 732 bales of 392 lb. in lint estimated in the Season and Crop Report of the previous year, representing an increase of 25·2 per cent. 81,300 acres are estimated as standing on the ground for Kar : or second pickings in the Central and Southern Districts. The yield per acre is expected to be below the normal in these districts and the total yield from the Kar or second pickings is estimated at 22,100 bales of 392 lb. in lint.

Statistics — Crop — Sugarcane — 1949 — 50 Intermediate condition report. The sugarcane crop in Guntur is reported to have been affected to some extent by heavy rains. In Bellary, the crop has been affected to some extent for want of adequate supplies of chemical fertilisers in time. The condition of the crop is reported to be generally satisfactory in all the other districts of the Province. The wholesale price of jaggery per imperial maund of 82 2/7 lb. (equivalent to 3,200 tolas) on 10th September 1949 was Rs. 24—11—0 in Adoni and Cuddalore, Rs. 24—0—0 in Erode, Rs. 24—4—0 in Coimbatore, Rs. 23—8—0 in Tiruchirapalli and Mangalore, Rs. 23—0—0 in Vellore, Rs. 22—10—0 in Bellary, Rs. 21—0—0 in Visakhapatnam, Rs. 20—15—0 in Chittoor, Rs. 20—9—0 in Kakinada, Rs. 17—4—0 in Rajahmundry, and Rs. 13—11—0 in Vizianagaram. When compared with the prices reported in the previous report, i. e., those which prevailed on 13th August 1949, these prices reveal a rise of approximately 32 per cent in Kakinada, 16 per cent in Visakhapatnam, 10 per cent in Adoni, 8 per cent in Bellary, 7 per cent in Vizianagaram and Coimbatore, 4 per cent in Cuddalore and 3 per cent in Vellore and Tiruchirapalli, the prices remaining stationary in Erode, Mangalore and Chittoor.

Statistics — Pepper — 1949 — First forecast report: The area under pepper upto 25th August 1949 in the districts of Malabar and South Kanara is estimated at 93,500 acres, (85,200 acres in Malabar district and 8,300 acres in South Kanara district) as against 92,500 acres (83,400 acres in Malabar district and 9,100 acres in South Kanara district) estimated for the corresponding period of last year. Due to excessive rains in Malabar at the time of ploughing and setting the yields are expected to be below normal in that district. The condition of the crop is fair in South Kanara district and normal yields are expected. The wholesale price of pepper per Imperial Maund of 82 2/7 lb. or 3,200 tolas as reported from important market centres on 10—9—1949 was Rs. 331—4—0 in Kozhikode, Rs.30 8—8—0 in

Mangalore and Rs. 305—8—0 in Tellichery, when compared with the prices published in the final forecast report for 1948 i. e. on 8—1—1949, these prices reveal an increase of 181% in Kozhikode, 145% in Tellicherry and 62% in Mangalore.

(From the Economic Adviser, Government of Madras.)

Cotton Raw, in the Madras Presidency: The receipts of loose cotton at presses and spinning mills in the Madras Presidency from 1st February 1949 amounted to 3,28,365 bales of 392 lb. lint. The receipts in the corresponding period of the previous year were 3,24,177 bales, 4,34,157 bales mainly of pressed cotton were received at spinning mills and 4,445 bales were exported by sea while 86,089 bales were imported by sea mainly from Karachi and Bombay.

(From Director of Agriculture, Madras.)

Agriculture College and Research Institute, Coimbatore

LIST OF ADDITIONS TO LIBRARY FOR SEPTEMBER 1949.

1.	ANDERON: (Edvar)	Introgressive hybridisation.	1949
2.	BEVERIDGE (William):	Social insurance and allied services Report (reprint)	1949 1948
3.	CONN (H. J.):	History of Staining—Edition 2.	1948
4.	CONN (H. J.):	Biological stains—a handbook on the nature and uses of the dyes employed in the biological laboratory Edn. 2	1948
5.	COTTON (C. A.):	Landscape as developed by the processes of normal erosion Edn. 2. Revised and enlarged.	1948
6.	DONALD (E.H.) Frear:	Catalogue of insecticides and fungicides Vol. II Chemical fungicides and Plant insecticides	1948
7.	GILMAN (Joseph G):	Manual of Soil fungi	1947
8.	IMMS (A.D.):	General text book of Entomology, including the anatony, physiology, development and classification of insects Edn. 7.	1948
9.	KENNIS DOOR (Warren):	Zaden atlas. der Nederlands che Flora Len Bcheeve Van de Botanic. Palaeon fologre Bodemaculture	1947
10.	KRISHNAN (M. S.):	Geology of India and Burma	1949
11.	LYON (Lyttleton) and Buckman (Harry O.):	Nature and properties of soils: a college text book of edaphology Edn. 4. revised	1949
12.	MARTIN (Hurbert):	Scientific principles of Plant protection with special reference to chemical control. Edn. 3	1948

13. MITCHELL (John W) and MARTH (Paul C.) : Growth regulators for garden, field and orchard 1947

14. PATERSON (William F): Man, weather and sun Edn. 1. 1947

15. PATIL (P. C.) : Food problems in India in general and in Kolhapur State in particular. 1948

16. PHILLIPS (John) : Agriculture Act. 1947 1948

17. RHIND (D): Grasses of Burma, 1945

18. ROBERTS (William) and KATAR SINGH (S.B.S.) : Text book of Punjab Agriculture 1947

19. SKINNER (charles E) : Henrici's Molds, Yeasts and Actinomycetes—a handbook for students of Bacteriology. Edn. 2

20. SNEDECOR George W) : Statistical methods applied to experiments in Agriculture and biology Edn. 4. 3rd print 1948

21. SOUTHGATE (B.A.) : Treatment and disposal of Industrial waste waters, reprinted 1945

22. VAKIL (C. N.) Economic consequences of partition 1949

23. VISWANATHA IYER (K.P.) : etc., Indian Press Yearbook. 1949

24. VAN MUREN (J.PJ.) : Soil fertility and sewage—an account of pioneer work in South Africa in the disposal of town wastes 1949

25. WESTON (W. A. R. Dillon) and Taylor (R. Eric) : Plant in health and disease 1948

26. A Ceruti ungi.- Analytice. De lineati. I combus Pictis illustrati. fungi and their structre Les. champignas. Leier Anatomic et. Histoire. Vol. I. 1948

27. Annual Report on the progress of Chemistry for 1947.

28. Advances in Biological and Medical Physics Edited by H. Lawrence and Joseph G. Hamilton I Vol. 1489

29. Everybodies Radio manual: How to build and repair radio receivers prepared by the Editorial staff of Popular Science Monthly 1942

30. Indian Union map (Commerce map of the Indian Union) ;

31. Note book of Tropical agriculture : Compiled by R. Cecil weed. 1948

32. Radio for the millions, prepared by the Editorial staff of the Popular Science Monthly. 1946

33. Trees for towns and country—a selection of sixty trees suitable for general cultivation in England prepared for the Association for planting and regional reconstruction.

D. B. K.

Weather Review — For September 1949

RAINFALL DATA.

Division	Station	Actual for month in inches	Departure from normal in inches	Total since January 1st in inches
Orissa & Circars.	Gopalapore	6·7	—0·8	17·3
	Calingapatam	10·3	+3·4	23·5
	Vizagapatam	11·6	+5·0	26·3
	Anakapalle*	14·7	+7·1	32·7
	Samalkot*	9·3	+4·1	32·4
	Kakinada	7·0	+0·8	42·2
	Maruteru*	5·2	—0·6	32·8
	Masulipatam	7·0	+0·6	37·8
	Guntur*	5·3	+0·1	32·0
	Agrl. College, Bapatla*	12·0	+3·8	41·5
	Veeravanam* (College Farm)	14·1	(x)	38·2
Ceded Dists.	Kurnool	17·7	+11·7	34·6
	Nandyal*	...	...	...
	Hagari*	6·1	+1·6	14·2
	Siruguppa*	10·6	+4·9§	22·6
	Bellary	5·9	+1·0	14·0
	Rentichintala	4·1	—0·7	25·4
	Cuddapah	7·8	+1·8	28·6
	Anantha-rajpet*	5·9	+2·5	34·2
Carnatic.	Nellore	8·5	+4·0	34·3
	Buchireddi-palem*	8·3	+5·4	26·5
	Madras	6·8	+2·1	27·8
	Tirurkuppam*	12·5	+6·5$	42·2
	Palur*	3·8	—4·0	25·2
	Tindivanam*	3·5	—2·8	19·9
	Cuddalore	2·8	—2·4	23·0
Central.	Vellore	4·0	—2·9	32·5
	Gudiyatham*	3·3	—2·0	30·5
	Salem	3·7	—2·4	24·9
	Coimbatore (A. C. R. I.)*	0·2	—1·1	9·5
	Coimbatore (C. B. S.)*	0·2	—1·5	10·2
	Coimbatore	0·3	—1·3	11·0
	Tiruchirapalli	7·0	+3·0	28·3

Division	Station	Actual for month in inches	Departure from normal in inches	Total since January 1st in inches
South.	Negapatam	3·7	+0·4	15·2
	Aduturai*	5·0	+1·1	22·6
	Pattukottai*	4·0	—0·1	17·7
	Mathurai	5·1	+0·4	33.5
	Pamban	0·1	—1·0	11·1
	Koilpatti*	0·8	—2·0	13·00
	Palamcottah	...	...	13·0
	Amba-samudram*	1·1	+0·1	8·0
West Coast.	Trivandrum	4·0	—0·5	47·0
	Cochin	27·4	+19·7	124·4
	Calicut	16·3	+9·7	128·3
	Pattambi	11·0	+7·1	91·5
	Taliparamba*	15·3	+7·1	155·0
	Nileshwar*	17·8	+9·0	162·6
	Pilicode*	17.8	+8·4$	155·8
	Mangalore	17·0	+7·6	156·6
	Kankanady*	17·4	+8·2	157·7
Mysore & Coorg.	Chitaldrug	3·1	—1·3	12·9
	Bangalore	4·0	—2·7	31·7
	Mysore	1·6	—3·4	18·4
	Mercara	20·7	+9·6	113·6
Hills.	Kodaikanal	2·8	—4·5	33·1
	Coonoor*	3·2	—0·6	23·0
	Ootacamund*	1·8	—3·0	30·3
	Nanjanad*	6·0	+1·3	33·7

Note :—

(1) * Meteorological Stations of the Madras Agricultural Department.

(2) Average of ten years data is taken as the normal.

(3) x Readings are recorded only from February 1948.

(4) $ Average of six years data for Tirurkuppam and seven years data Pilicode is given as normal.

(5) § Taluk office normal is .... and rainfall ....

(6) ... Figures are not available.

Weather Review for September 1949

The monsoon was active along the West Coast during the beginning of the month causing widespread rains in Kerala and South Kanara. But owing to a general rise in pressure over the whole country on 4—9—49 the monsoon became feeble. The presure over the country fell below normal on 6—9—49 and a shallow depression associated with markedly unsettled conditions was observed off the East Coast between Chandbali and Vizagapatam on 7—9—49. This resulted in the strengthening of the monsoon along the Kanara Coast. The Bay depression crossed the coast on 8—9—49 causing widespread rains in North Andhradesa.

The monsoon was apparently strengthening in the South-East Arabian Sea on 10—9—49 causing widespread rains in Malabar, but became weak on 11—9—49. The monsoon strengthened the very next day due to the development of upper air discontinuity and a shallow low in association with a low pressure wave, which moved into the central bay from the Andaman Sea, resulting in widespread rains along the West Coast and thundershowers at several places in Andhradesa and Tamilnad. The shallow "low" moved inland on 19—9—49 and became unimportant after four days.

Another low pressure wave moved into the East Central Bay from the North Andaman Sea on 17—9—49, causing unsettled conditions and a deep depression over East Bay, which moved North-West bringing the upper winds upto 12,000 over eastern half of the Peninsula into the grip of cyclonic circulation on 19—9—49. This deep depression crossed the coast near Masulipatam on 21—9—49 and passed over Hyderabad-Deccan to the Central Provinces and got filled up on 25—9—49. This resulted in widespread and local heavy rains in Andhradesa and Rayalaseema from 20—9—49 to 24—9—49 and floods in the Krishna river. From 12—9—49 to 25—9—49 there were fairly widespread rains in Malabar and South Kanara. There was a general rise in pressure over the country on 26—9—49 and air became drier over South Malabar resulting only in local showers over the region till 30—9—49.

The note-worthy falls in the month are given below :—

Date	Place	Rainfall in inches
3—9—1949	(Nungambakkam) Madras	2·8
7—9—1949	Kozhikode	2·9
8—9—1949	Calingapatam	2·2
14—9—1949	Cochin	2·8
18—9—1949	Mangalore	2·5
19—9—1949	Anantapur	2·1
20—9—1949	Alleppey	4·6
21—9—1949	Nellore	3·7
,,	Cuddapah	2·9
,,	Kurnool	4·7
,,	Ongole	4·6
22—9—1949	Ongole	9·2
,,	Kurnool	3·9
26—9—1949	Vizagapatam (Aerodrome)	5·7

C. B. M.

Departmental Notifications

GAZETTED SERVICE—POSTING AND TRANSFERS.

Name of Officers	From	To
Sri Bujanga Rao, C.	On leave,	Asst. Fruit Specialist, Banana Research, Station, Aduthurai.
,, Muthaiah Nattar, A. M.	On leave,	D. A. O., Mathurai.
,, Nair, P. N.	Special D. A. O., Coimbatore,	D. A. O., Ootacamund.
,, Suryanarayana, V.	D. A. O., Ootacamund,	Asst. M. O., Kakinada.

SUBORDINATE SERVICE.

Sri Amirtha Raj, E.	A. D., Mathurai,	Paddy Asst. Seed Development Scheme—N. Arcot District.
,, Arunachalam, T.	A. D., Melur,	A. D., Hosur.
,, Anavarathan, L.	Asst. in Millets, Coimbatore,	Asst. in Millet, A. R. S., Koilpatty.
,, Anantham Pillai, S.	On leave,	A. D., Gobichettipalayam.
,, Akkaya, N.	F. M., A. R. S., Siruguppa,	Paddy Asst. Seed Development Scheme, Amalapuram.
,, Bhaskara Rao, V. K.	Asst. in Mycology, Coimbatore,	A. A. D., Gobichettipalayam.
,, Chakko, C. J.	Asst. in Fruits, Mettupalayam,	A. D., Alathur.
,, Dakshinamurthi, V.	F. M. Araku.	A. A. D., Rajahmundry.
,, Dinaker Rao, K.	A. D. Udipi,	Paddy Asst., S. Kanara Dt.
,, Dharmalingaswami, P.	A. D. Bellary,	Asst. in Millet; Seed Development Scheme, Bellary.
,, Gopala Rao, M.	A. D. Palagoda	Paddy Asst., Seed Development Scheme, Chicacole.
,, Gnanavaram, I.	Ento-Mycology Training at Coimbatore,	Plant Protection Asst., Pattukottai.
,, Hanumantha Rao, B.	A. D. Ongole,	Millet Asst., Seed Development Scheme, Cuddapah.
,, James Colaco.	On leave,	Special A. D., Sugarcane Scheme, Mangalore.
,, Kalimuthu, M.	A. D., Bhavani,	A. D., Gudiyatham.
,, Koteswara Rao, M.	A. D., Hospet,	Asst. in Paddy, Seed Development Scheme, Vijayavada.

Names	From	To
Sri Lakshmanan, S.	Teaching Asst. in Agricultural Training School, Orthanad,	A. D., Mayavaram.
,, Muthuswami, T. D.,	A. A. D., Villupuram,	Paddy Asst. Seed Development Scheme, Villuppuram.
Mr. Mohammad Maqbaloor Rahiman,	A. D., Kurnool,	Paddy Asst. Seed Development Scheme, Tanuku.
Sri Nalla Gounder, S. C.	A. D., Krishnagiri,	A. A. D., Attur.
,, Narasimha Rao, R.	A. D., Alur,	A. A. D., Avanigada.
,, Narasimhamurthi, H.	Special A. D., (Sugarcane) Hospet,	A. D., Hospet.
,, Narasimha Rao, I. L.	A. D., Sattanapalle,	Millet Asst. Seed Development Scheme, East Godavari.
,, Narasimham, B.	Horticultural Asst. Agricultural College, Bapatla,	Paddy Asst. Seed Development Scheme, Kishna.
,, Nageswara Rao, T.	A. D., Bapatla,	,, Guntur.
,, Narayana Iyer, N.	On leave,	A. A. D., Chingleput.
,, Nagaeswara Sarma, D.	A. D., Rapur,	Paddy Asst. Seed Development Scheme, Gudivada.
,, Narayanaswamy, K. H.	Paddy Asst. Pattukottai,	,, Pattukottai.
,, Padmanabha Raju, P.	On leave,	,, Vijayavada.
,, Prahlada Rao, G.	Soil Conservation Asst. Bellary,	A. A. D., Bellary.
,, Radhakrishnamurthi, K.	Soil Conservation Asst. Bellary,	F. M., Samalkota.
,, Raman, A.	Asst. in Millets, Coimbatore,	A. D., Bhavani.
,, Ramana Rao, D. V.	F. M., S. R. S., Anakapalli,	Paddy Asst. Seed Development Scheme, S. Vizagapatam District.
,, Ramalingam, M.	On leave,	Paddy Asst. Seed Development Scheme, Nellore.
,, Rama Rao, B. K.	A. D., Hosur,	Speccial A. D., Firka Development Work, Kumlala.
,, Sankaranarayana Iyer, C. S.	A. D., Palghat,	Paddy Asst. Seed Development Scheme, Palghat.
,, Syed Mohmmad, D. H.	On leave,	A. D., Krishnagiri.
,, Srinivasan, K. V.	Asst. in Mycology, on Deputation at I. A. R. I., New Delhi,	Asst. in Mycology, Coimbatore.
,, Subbaiah Pillai, R.	A. D., Thirumangalam,	A. D., Firka Development Scheme, Thirumangalam.
,, Sankaranarayanan, R.	Millet Asst. A. R. S., Koilpatti,	A. D., Thirumangalam.
,, Satyanarayana Rao,	Soil Conservation Asst.	A. D., Ramachandrapuram.

Names	From	To
Sri Suryanarayana Sarma,	A. D., Rayachoti,	Paddy Asst. Seed Development Scheme, Godavari.
,, Srinivasan, V.	A. D., Ramanad,	Millet Asst. for Ramnad and Tinnevelly with H. Q. at Koilpatti.
,, Sriramulu, K.	On leave,	Millet Asst. Seed Development Scheme, Narasaraopet.
,, Satyanarayana Rao, G.	A. D., Palmaner,	Paddy Asst. Seed Development Scheme, Anantapur.
,, Sangameswara Sarma, S.	Teaching Asst. in Agri. Agricultural College, Bapatla,	Asst. in Charge Pulses. Breeding Station, Vizayanagaram.
,, Venkatanadha Chary, G.	A. D., Adoni,	Paddy Asst. Seed Development Scheme, Bhimavaram.
,, Veerabhadra Rao, N.	A. D., Uravakonda,	Millet Asst. Seed Development Scheme. Anantapur
,, Venkatapathi Naidu, C.	A. D., Hadagalle,	,, Kurnool.
,, Vaidyanathan, N. S.	A. D., Alathur,	,, Palghat.
,, Sithapathi Rao, C.	F. M., Hagari,	Soil Conservation Asst. Bellary.
,, Narayana Reedy, B.	Special A. D., Hindupur,	,, ,, Bellary.
,, Ranganathaswami, G,	P. A., to D. A. O., Vijayavada,	Millet Asst. Seed Development Scheme, Cuddapah.
,, Hanumantha Rao, D.	F. M., Agricultural College, Bapatla.	P. A., to D. A. O., Vijayavada.

The following B. Sc., (Ag.) Graduates are appointed as upper subordinates and are posted to the vacancies shown against each.

Name	To
Sri Appavu Naidu. C.	A. A. D., Madanapalli.
,, Azamatulla Khan.	A. A. D., Vijayavada.
,, Anjaneyulu, K.	Asst. in Fruits, Mettupalayam.
,, Banjee Rao, B.	A. A. D., Chidambaram.
,, Butcheswara Rao, A.	,, Chodavaram.
,, Bhaskara Rao, K.	,, Gannavaram.
,, Balasubramaniam, K. R.	,, Erode.
,, Bhaskara Rao, U. K.	Asst. in Mycology, Coimbatore.
,, Balasundaram, I.	A. D. Dharmapuri.
,, Balasubramaniam, K. N.	A. A. D. Udamalpet.
,, Dorai, S.	A. D. Nilakottai.
,, Dharma Rao, B.	A. A. D. Kudligi.
,, Gopalakrishnaiah, K. V.	,, Atmakur.
,, Gopala Rao, B. V.	,, Nellore.

Name	To
Sri Gangaprasada Rao, N.	,, Ongole.
,, George Vasantha Rao,	,, Eluru.
,, Gopalaratnam, G.	,, Cuddalore.
,, Gopinath, M.	A. D. Sidhout.
,, Gopinatha Rao, P. V.	,, Palmaner.
,, Harichandramurthi, L.	A. A. D. Tenkasi.
,, Jayaraman, A.	,, Bobbili.
,, Krishnamurthi, P. P. V.	A. D. Rapur.
,, Krishnasarma, J.	,, Kurnool.
,, Krishnamurthi, M.	A. A. D. Gudiyattam.
,, Kameswarasarma, V.	,, Thiruvannamalai.
,, Krishna Mohan, V.	A. D. Ramnad.
,, Krishnamurthi, P. S.	,, Wallajah.
,, Krishnamurthi, T.	Asst. in Paddy, Coimbatore.
,, Koteswara Rao, K.	A. A. D. Alur.
,, Krishnamurthi, B. H.	,, Anantapur.
,, Karunakara Rao, A.	,, Kurnool.
,, Krishnamuthi, P.	,, Jammalamadugu.
,, Lakshminarayana, M.	,, Kadiri.
,, Madhava Rao, T.	A. A. D., Gudivada.
,, Muthugopal, K. R.	Teaching Asst., Agrl. Training School, Orathanad.
Janab Md. Abdul Hameed,	A. A. D., Bhimavaram.
Sri Mallikarjuna Rao, Y.	,, Tanuku.
,, Manickaya Rao, V.	Soil Conservation Asst., Bellary.
,, Neelakantiah, O.	A. A. D., Vellore.
,, Narayanan, S.	Asst. in Mycology, Coimbatore.
,, Narasimha Rao, P.	A. A. D., Kurnool.
,, Narayan Rao, B.	A. D., Hadagalle.
,, Narayana Reddi, M. L.	F. M., Bapatla.
Sreemathi P. Parvathi.	Lady Demonstrator, Kakinada.
Sri Patnaik, U. J.	A. A. D., Pithapuram.
,, Purnapragnachar, H.	A. D., Adoni.
,, Ramakrishna Rao, J.	,, Anakapalli.
,, Ramachandra Rao, M.	A. A. D., Polur.
,, Ramana Rao, A.	,, Tanjore.
,, Ramachandra murthi, A. S.	A. D., Koilpatti.
,, Rama Rao, K.	A. A. D., Sringavarapukottai.
,, Rajaratnam, J.	,, Amalapuram.
,, Ravindra Rao, G.	,, Repalle.
,, Ranga Reddy, B.	,, Nandyal.
,, Rafeuddin Elias Khany.	,, Adoni.
,, Ratnakara Rao, T. V.	,, Hospet.
,, Ramesan, V.	Asst. in Oilseeds, Tindivanam.
,, Ramani, P.	Special A. D., Udumalpet.
,, Swaminathan, S.	A. D., Perambalur.
,, Sundhara Singh, M.	,, Tenali
Sreemathi Pushpaveni	F. M. S. R. S., Anakapalle.
Sri Suryanarayana, P.	A. D., Cuddapah.
,, Sadasiva Reddy, G.	A. A. D., Cuddapah.

Name	To
Sri Siva Reddi, S.	,, Hindupur
,, Subbiah, J.	,, Kandukur.
,, Shaik Imam.	,, Kovur.
,, Suryaprakasa Rao, P.	,, Markapur.
,, Seshachala Sarma, C.	,, Kakinada.
,, Seethapathi Rao, S.	,, Peddapuram.
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